The International Journal of
Orthodontia, Oral Surgery and Radiography
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VOL. IX ST. LOUIS, FEBRUARY, 1923 No. 2

## ORIGINAL ARTICLES

# STATUS THYMICOLYMPHATICUS, WITH SPECIAL CONSIDERATION OF GROWTH DEFECTS AND THEIR AUTOMATIC COMPENSATIONS*

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WHEN your president honored me by inviting me to present an address before your Society, the thought arose in my mind to discuss a subject which, while endocrinologic in substance, had points of contact with all special fields of medicine and surgery, and particularly with dental medicine. Such a discussion would tend incidentally to show the close and intimate relationship existing in all these branches and their mutual interdependence.

My subject is status thymicolymphaticus, and briefly defined may be said to be a constitutional condition arising congenitally, characterized usually by a large thymus gland, enlarged lymphoid tissues and deficiency in other important structures, making the individual nonresistant to attacks upon his life by disease and allied states. For many years there have appeared in medical literature dissertations on the subject of status thymicolymphaticus from the viewpoint of the pediatrist, or the internist, or some other specialist who had become interested in the condition because of its bearing in his particular field. Always were warnings uttered as to the importance of its recognition, for always did its presence modify symptomatology, treatment, and prognosis. These papers have never gone into the later history of the conditions through the developmental years to adult life, or to mark its metamorphosed characteristics and the attempt of the individual to compensate for its disturbances. In the past ten years it has been my fortune to examine many hundred cases of status thymicolymphaticus in all stages of development, in-

*Read before the American Society of Orthodontists, Chicago, Ill., April 24-26, 1922.

cluding adult cases, in whom the early history gave indubitable evidence of such disturbance; and, as a result of a more or less comprehensive study of these cases, certain general conclusions have been drawn which I shall attempt to present to you, together with the facts upon which they are based.

Reviewing the general symptomatology of status thymicolymphaticus as a basis from which we shall proceed, I shall endeavor to present to you the outstanding features of this condition.

1. *Skeleton.*—Growth of skeleton is usually abnormal in that the various units are disproportionate,—thorax too long for legs, and vice versa; hands and feet too long for arms and legs; bony structure usually frail, and rachitic evidences are frequently present. A maxillary torus is in evidence.

2. *Teeth.*—Almost invariably there is delay in the deciduous as well as in the permanent dentition with prominence in size of the central incisors of the upper jaw, with comparatively small lateral incisors, and canines that have lost, or rather not acquired, the fang-like shape, but resemble the incisors in that they have a cutting edge. The molars appear very late. The color of the teeth is usually a bluish white, with a porcelain translucency.

3. *Joints.*—The tendons about the joints are loose and therefore dislocations and subluxations are frequent, together with ability to produce marked contortions of the body. The extremities are like flails, and the whole skeleton is of a loosely-put-together character. The apparently fixed joints, such as the sacroiliac, become partially movable, and therefore are the seat of intense backache on fatigue. Like conditions obtain in joints of the foot, and pes planus is the result.

4. *Skin.*—The skin is soft and velvety, covered with lanugo, frequently with a marked blush on the cheeks,—a typical "peaches and cream" complexion. The bluish vessels are easily seen through the translucent skin.

5. *Hair.*—While lanugo covers the parts which would later be provided with secondary hairy growth, yet such later growth is very late in appearance. Axillary hair and pubic hair do not come in until long after the usual time for the arrival of puberty, and in the boy, beard and mustache are still later, and then very sparse. The growth on the head is, however, profuse. The character of the hair is soft and silky.

6. *Genital System.*—In the boy there is usually retardation in growth of the genitals, and not only this, but the growth is of undifferentiated character, so that there is a fold of the scrotum which partially or even entirely surrounds the base of the penis, resembling the labia in the female. Occasionally, one or both testicles are undescended, and there may be hypospadias. In the girl the clitoris is usually disproportionately large, the menses come on late and are delayed and irregular.

7. *Eyes.*—The pupils are usually large and mobile; the sclera, clear bluish-white; and the vessels of the fundus are extremely thin in calibre, without engorgement of the veins.

8. *Endocrine Glands.*—The *thyroid gland* shows no abnormalities in size, although it is usually under-functionating; the *thymus gland* is present and usually large even after the twelfth year. Percussion and roentgenography

will confirm this. The picture should be made at the end of a long expiration. However, the large thymus gland itself is only a part of the picture—and probably not the most important factor at that. The *adrenals* are invariably deficient, both as to size and chromaffin content. Indeed, the chromaffin tissues throughout the body are deficient. The *pituitary gland* is usually small and is encased in a sella turcica, which is small and enclosed by the clinoids. This fact is of great importance in the further history. The *gonads* are usually small and delayed in development and in differentiation.

9. *Vasomotor System.*—The blood vessels are of small calibre throughout the body, especially the aorta and the coronary arteries. The heart is small. In this hypoplastic vasomotor system lies perhaps the chief danger of the condition, and the basis for many of the symptoms.

10. *Viscera.*—The viscera frequently show a tendency to splanchnoptosis. Incontinence of urine; enuresis. The lack of tone of these organs underlies the many gastrointestinal symptoms.

11. *Laboratory Findings.*—Blood; red blood cells and hemoglobin, usually normal; white cells show a marked relative lymphocytosis with a low polymorphonuclear count, which at times is as low as five per cent. Usually an eosinophilia is present; blood sugar is usually low—.080 per cent down to .060 per cent. Of importance is the carbon dioxide tension of the blood plasma, which is invariably low, 45 to 50 per cent. This means a low alkaline reserve—and a tendency to acidosis. So that hyperacidity is a general concomitant. The coagulation time is prolonged, often as long as 15 minutes. The urine has a low specific gravity and not infrequently shows the presence of acetone.

12. *General Observation.*—From the foregoing, the symptoms exhibited by the patients are readily understood. These are fatigue and dyspnoea on exertion; fainting attacks and collapse in critical situations; syncope and death in narcosis, fright and exhaustive demands. The symptoms depend upon the low chromaffin supply, the small blood vessels, the low blood sugar and the tendency to acidosis. Death is not usually due, as has been thought, to pressure of the thymus on the trachea, or, at any rate, only in the rarest cases, but is due to adrenal exhaustion, or hemorrhage from the smaller blood vessels into important structures such as the brain. Urticaria, asthma, acidosis, enuresis, hay fever, circumscribed edema, arthritides, are all concomitants. Blood pressures are low, and pulse pressure frequently down to 10 or 15 mm.

From the general description, no matter what your field of work may be, you will all recognize cases that have come under your notice. These cases do not all die in growth or adolescence, nor does even a large number of them. What becomes of the survivors? How do they manage to maintain themselves in the struggle for existence? Do they constantly remain a prey to their deficiencies? These questions possibly can now be answered. The development and evolution out of status by the individual's intrinsic powers of compensation and adaptability form one of the most interesting chapters in modern medicine, and their recognition will enormously aid us in our

power to help hitherto obscure and apparently adventitious symptoms in our patient's progress, no matter what his ailment, no matter what our specialty.

The very first consideration in the difficulty of adaptation to environment of the status case is the outstanding fatigue. This, as has been said, is due to several factors,—the adrenal insufficiency, the low blood sugar content, the low alkaline reserve, and the low blood and pulse pressures; if there were any possibility of overcoming these basic difficulties, a large measure of improvement would take place. But is there in the human economy any possibility of such autonomous regulation? If, for instance, splanchnic stimulation, such as is efficient in shock, were to occur, might the situation not be overcome? The stimulation of the splanchnic or the sympathetic system generally depends for its effect largely upon an adrenalin reserve. This is wanting in the status cases. Stimulation by thyroid secretion also depends upon the sensitization of the neuromuscular synapse by thyroid extract to the action of adrenalin. Again, the same difficulty. However, a long continued stimulation of the adrenals by the thyroid will gradually produce an hypertrophy of the adrenals and hence give one method of compensation for the status situation. Also, one tissue which will produce the wherewithal, independent of adrenalin, to increase blood pressure and the blood sugar content, is the pituitary body. Does increasing activity of this gland actually occur?

At this point, I would ask your indulgence to the extent of picturing to you the progressive history of a thymic state which is compensating on a pituitary basis. It will serve perhaps to show the many symptoms exhibited by these cases as they progress to cure spontaneously.

We find two groups of status cases, one, by far the larger, in which the sella turcica on x-ray examination is found to be small and enclosed; and the other in which the sella is presumably normal in size and conformation. The symptomatology in the two cases is different in important particulars, and it is the former group which is of interest to us now. In the *small, enclosed sella* group there is, always associated with the fatigue states, headache. This headache is intratemporal in situation; of intense, painful boring, or pressure, or throbbing in character; and more or less periodic in its onset. Its periodicity is menstrual or seasonal; and yet it may be produced by any factor which will stimulate the pituitary gland. For instance the ingestion of large quantities of carbohydrate food; cerebral hyperemia due to the intense cerebration of long-continued worry or chagrin or mental effort; injections of anterior lobe pituitary extract; and similar stimulants. Just before the headaches begin, the blood and pulse pressures are low in our cases, while during the headache period both rise, as does the blood sugar content; after a year or two or three of such constantly recurring headaches, interesting data are available. These are as follows: blood pressure, pulse pressure and blood sugar content are all on a higher level; there has been a rapid increase of skeletal growth; and an x-ray of the skull shows a sella turcica that presents erosions and thereby an enlargement of its cavity.

With these facts at our disposal, I believe that the conclusion is not very far fetched that pituitary hyperactivity has occurred and with it an amelio-

ration of the asthenic symptoms. In other words, there has been a compensation process inaugurated automatically, which has served to overcome many of the symptoms of disability possessed by the status case. This compensatory process proceeds for years, the sella turcica becoming more and more eroded, the headaches gradually becoming less and less intense and less frequent, the skeletal growth, however, going on apace. Now, other symptoms of pituitary primary activity and other glandular activity secondarily, begin to present themselves. There is gonadal growth; undescended testicles come down, and secondary hairy growth begins. The young man that has reached this period of compensation gives somewhat the following picture: His age is twenty; he is six feet or more in height; his skin, while still smooth and velvety, has begun to look more rugged; the first hairs of mustache or beard are beginning to show themselves; his pubic hair, which has been for a few years scanty and feminine in its distribution, begins to encroach on the middle line of the abdomen towards the umbilicus; his joints are loose, subluxation of the mandible or of the carpometacarpal joints being readily produced; he has the large central incisors of the upper jaw; a "torus palatinus" is evident; but he is getting to be more efficient in his study and in his play, and his fatigue is diminishing. He still has headaches, sometimes very severe. It is for this symptom that he sees the oculist or the rhinologist or the internist or the neurologist. Careful inquiry into his developmental history will elicit many symptoms of the foregoing group, and he will be recognized as being in a transitional stage of compensation from an early status thymicolymphaticus. The rapid skeletal growth and the headaches will lead the careful clinician to examine the sella and the thymic region, and there the telltale marks of his progress will be seen. At once it will be recognized that the extreme height and the headaches and the spacing of the teeth, are simply the hallmarks of a *purposeful compensatory process* on the part of the pituitary gland to overcome the disabling characteristics of a status thymicolymphaticus, and are not *disease symptoms* in themselves. This is highly important to know both for purposes of treatment and for prognosis. As we watch his progress through the years, he goes on growing, though less and less in degree; his headaches come on only after undue fatigue or exertion; the thymic x-ray shadow disappears; he may grow both mustache and beard; his blood pressure, pulse pressure, blood sugar content, coagulation time,—all approach normality, and finally even his growth ceases. We have before us a moderate giant, six feet two inches in height, who has finally matured, physically, psychically, and sexually at the thirtieth year of life, instead of at the twenty-first. He will always be conscious of some limitation to his physical possibilities, but will be able to survive in competition with his fellows. In other words, he has gone to cure through spontaneous compensation. Looking back over his career, the recognition of the milestones of his progress gives us the keynote of one treatment which we may accord his less fortunate brethren in their partial or complete failure to follow his trail. That keynote is the *ability of the pituitary body to become hyperactive* in order to compensate for the initial adrenal insufficiency.

If it is true that an overactivity of the thyroid and the pituitary will tend to compensate and hence overcome the disabilities of the thymicolymphaticus state, we ought to see the changes induced in the thymic individual by these overactivities. The pituitary changes have already been generally indicated—as this seems to be the most important compensatory glandular element in the situation. But what particularly interests us at present, is the change in the character of the teeth that the compensating individuals show.

For this purpose, we must divide our patients into two groups: those that do not begin compensation until the eighth or tenth years of their existence; and a second group consisting of those that begin compensation during their early infancy. These two groups show very distinct differences in tooth formation.

*1st Group.*—Children with status thymicolymphaticus usually have a late first dentition, and then the appearance of the teeth is not always in the usual chronological order. That is to say, instead of the central incisors appearing first, they may appear much later than the other teeth. There is usually a well-marked torus palatinus. The arch of the palate is variable and will change, depending upon the character of the compensation effected and the glandular organ which bears the brunt of the contest. By the time the permanent dentition appears, sufficient compensatory activity may have occurred to make its mark upon the teeth. If there has been little or no compensation, however, then the central incisors of the upper jaw of the permanent dentition become very large and prominent, the lateral incisors quite small and insignificant, both in a longitudinal and transverse diameter and their texture is of such character that they easily decay. At times, one or both lateral incisors are altogether absent, and of this significance more will be said later. The canines in these uncompensated cases are usually without the slight yellowish pigmentation that canines generally exhibit normally, and they have a horizontal cutting free edge much like the incisors, instead of the pointed, fang-like terminal projection normally beyond the general level of the other teeth, and their edge is on the same plane as that of the other teeth. The third molars in both upper and lower jaws frequently remain unerupted or at times are entirely absent. So that the array of teeth in the uncompensated status case is frequently quite an orderly even-lined one with the exception of the extremely large size of the central incisors. A jaw showing teeth with these characteristics stamps the possessor at once as of this class of patient. Further inquiry will elicit many of the other facts of a status thymicolymphaticus, namely, abnormality of hairy growth, abnormality of stature, abnormality of genitals and abnormality of the biochemistry of the individual. In behavior he is fearsome and apprehensive, and psychologically he has feelings of inferiority and inadequacy. His blood pressure is low, he has great fatigability and he is nonresistant to infection, narcosis, fright and overexertion. But the possibility remains of his compensation taking place later on in his evolution, after the permanent teeth are fully formed and erupted. In that case, the teeth are simply the indication that *he was* of the

thymic type *at the time they were formed* but has overcome the difficulties at that time present. Great care must be exercised not to interpret the signs of the teeth,—indeed, other structural signs as well—as of the period of examination. The interpretation must be made in terms of the period of life when they were formed. So that completely normal people may have teeth that show their thymic early life.

The second group of individuals, namely, those that compensate almost from the beginning of their life, have differences in their dentition which depend upon the nature of the compensatory process—upon the particular gland which controls the compensation. Thus, if the thyroid is the chiefly hyperactive organ, then the teeth show characteristics that are referable to this hyperactivity. Their characteristics are then in a general way hyperthyroidal. That is to say, the teeth take on the character of general hyperthyroidal growth which is *length*. Such an individual will have long and generally narrow teeth and as the palate and jaw formations are also long and narrow, the teeth are frequently crowded and overlap. If with the thyroid activity the gonads and adrenal glands are brought to normal action, then the lateral incisors and the canines will approach normality and we will have a picture of generally long teeth, central upper incisors larger than usual but the other teeth in fairly normal proportionate size,—but all crowded. If the pituitary gland at the same time increases its activity, then the jaw becomes broader, and the crowding disappears (all this in an individual who shows general bodily signs of a hyperthyroidism). Their teeth are strong and firm and resistant to disease.

If the pituitary is the active compensating gland, then the general growth characteristic is one of breadth. The jaw especially broadens, and the teeth become broad rather than long. Often, the broadening of the jaw and teeth is in favor of the jaw, and then spacing between the teeth occurs. Again, may we have added factors in the degree of compensation effected by thyroid, gonads and adrenals. If all follow the lead of the pituitary, then the teeth appear normal, but spaced, with large central incisors. If the adrenals lag behind, then we have canines like incisors with a cutting edge and not pigmented. If the gonads are not responsive to the pituitary activity, then the lateral incisors are small or even absent and the spacing becomes more marked. If the thyroid remains backward in the compensatory process, then the character of the teeth is such that they do not withstand infection and are a prey to bacterial invasion. Such cases also have a changed salivary secretion making for a lowered alkalinity of the saliva. It has been said that the thyroid stimulates the calcium secretion of the salivary glands and that the calcium salts give the saliva its alkaline reaction. The glands that secrete most calcium are the submaxillary, and the secretion of the submaxillaries is more alkaline than that from the parotids. Hence a thyroid deficiency will change the secretion of saliva in that it becomes less alkaline, and the parotid secretion suffers most in this respect. Therefore the molar teeth in such conditions are the first to suffer from the acidity thus tended to be produced, for they are behind the ducts of the submaxillaries. If the hypothy-

roidism is extreme, then all teeth tend to decay. Of course, it is understood that there may be all grades of compensation on the part of the secondary glandular organs and hence all grades of tooth differentiation. It becomes an extremely interesting matter to evaluate and integrate the types of dentition.

Of the canines and lateral incisors of the upper jaw, and the interpretation which may be made of their departures from normality, a great deal has been said and written, much of which cannot be substantiated, but which seems to have a basis firmer than that of coincidence. The canines, as already stated, seem to be developed to the greatest extent, as canines with a pointed, well marked fang, and a certain amount of brownish pigmentation, in those individuals that show the characteristics of the hyperadrenal make-up,—easy to anger, to fight, short on patience and compromise, tending to high blood pressure, and little susceptibility to fatigue. So that when the canines seem to be developed in this wise in an original status thymicolymphaticus case, one would look upon it as a favorable sign of compensation. And so frequently it is. Occasionally, we are disappointed in this interpretation for the compensation seems not to occur. There are so many other factors involved, however, that we are as little justified in denying the proposition as a universality on this ground as we are in asserting that our observations are merely coincidences in the first place. The lateral incisors of the upper jaw, also, have been a fruitful field of contention for some years. Against the assertions of many good observers, in a good many cases that abnormalities of these lateral incisors parallel disturbances of growth or function of the genital organs, we have the constant impatient query of the conservatives, "Why should this be so?" with a number of instances to the contrary which they cite out of their experience and a judicial opinion of "not proven." The writer has had a rather long experience in this group of cases,—that is to say,—status thymicolymphaticus, in which the absence or maldevelopment or other abnormality of the lateral incisors went hand in hand with congenital absence of the uterus, infantile sex organs, undescended testicles and many other conditions referable to genital maldevelopment. Perhaps at some not too distant day, a *raison d'être* for the association may be found. In some cases of partial compensation for the thymic state, will be found the curious permanence of the first dentition, especially in the bicuspids and molars. Such cases are in all probability hypothyroidal, for occasional success attends thyroid medication, if the permanent teeth can be disclosed by x-ray. These individuals have many of the characteristics of children even in their second periods of life.

The reading and interpretation of the story told by the teeth, therefore, is one of absorbing interest. The life history of the individual, his difficulties, his compensations for hereditary deficiencies, his success or failure in these contests may be surmised by their study. Just as the interpretation of the life history of the possessor of the Piltdown skull,—and hence of prehistoric man,—rests upon the single canine tooth found near it, so with much less difficulty ought we be able to read our patients' trials and tribulations and by just so much be the more able to remedy them and help them.

DISCUSSION

*Dr. William G. Stearns, Chicago, Illinois.*—I greatly appreciate the honor of being asked to address you. I want to express my appreciation of the masterly way in which Dr. Timme has taken a large subject, with much of its area still unexplored and has presented you with a distinct entity, giving types of variants, tracing the history of the growth and pointing out the factors that control development of the teeth in a class of cases that must be especially puzzling to the orthodontist.

Your Society is fortunate indeed in having a complex and many-sided clinical group placed so broadly before you, yet with the many phases of endocrine conflict so definitely pictured, that by noting the end results, as shown by the teeth, you are able to plainly read the outstanding events in your patients' struggle for complete development. In thus showing that the teeth are historical guide-posts that chronicle the ups and downs of this conflict affecting developmental life, Dr. Timme has done a great service to the dental and medical professions.

We are daily meeting adult individuals of this group. We are impressed by the disproportion of the trunk and extremities. A certain lack of robustness is noticed in posture and movements, evidenced by the delicate skin, fine hair and the absence of well marked sex attributes. While the large central incisors are almost invariably present they, as well as the other characteristic irregularities of the teeth are usually unnoticed, and when observed are passed by the medical man as not an essential part of the picture.

From now on we will have a greater interest in reading the histories of our patients from their teeth, and in the future we will look at the records and reports of the orthodontists for most valuable assistance in the study of the status thymicolymphaticus.

Endocrinology is certainly a land of promise for the orthodontists. It offers a most alluring field for research. Many of the theories we treat as facts need to be verified through animal experimentation and clinical experience. While the field has been only recently opened to our eyes, men of vision clearly comprehend that the endocrines are the arbiters of animal life. The endocrines played an important rôle in the origin of species, the evolution of man, the differentiation of races, the rise and fall of nations, creeds and sects.

In health and pestilence, feast and famine, peace and war, the results to the individual depend chiefly upon his endocrine stability. From conception, through life to death, each stage of life is controlled by a certain group of glands that gradually yields its ascendancy to the group dominating the stage following.

In this great new field Dr. Timme has entered as a pioneer, and like every successful pioneer, Timme is an enthusiast. Where we ordinary men can get a distinct vision of the distant snow-capped peak, Timme's vision reveals the rivulets, waterfalls, mountain lakes and mineral wealth. We need enthusiasts, men of vision, men who have enough faith in their visions to take the trouble to prove them to others. But to all members of the dental profession there is due a warning.

The blindest of you should be able to see the handwriting on the wall. Dr. Timme has explained it all to you. He has presented the subject in a most entertaining and alluring manner. But I am afraid that he lacked the nerve to put it over. Allow me to interpret. The endocrinologist broadens the child's narrow jaw and separates the crowded teeth with pituitary. He narrows the too wide jaw and brings the spread teeth in contact with thyroid. He makes the long teeth short with pituitary. He makes the short teeth long with thyroid. He makes the soft teeth hard with parathyroid. The dwarfed lateral incisors he gives correct proportions with gonads. To the short, stunted canines he gives the dog-like fighting form with adrenalin, etc. A gland for a jaw; a gland for a tooth; endocrinopathy wins, and the orthodontists applaud.

Along comes Broderick, a fellow of the Royal Society, with the skulls of his gland-fed rabbits, and proves that the exciting causes of dental caries may be now ignored. That immunity or susceptibility to dental caries depends upon the endocrine balance. With that

balance awry the dentist and patient are helpless. With that balance corrected their efforts are superfluous. Dental caries is now up to the endocrinologist.

Fresh from the secular press, under date of April 22, comes the report of still another advance in endocrinology.

"Elyria, O.—John Brinker, veteran of the Civil War, and ninety-two years of age, began doctoring himself for the mumps the other day, when his jaw began to swell. The usual remedies, however, brought no relief, and an examination disclosed that the veteran was cutting his third set of teeth. Brinker has used 'store' teeth for forty years.

" 'They gave me good service until a few weeks ago,' " the veteran said. Then my gums became sore, and the teeth just seemed to skid around, so I took them out and doctored for the mumps. But the more I doctored the more my gums swelled.

"When his new teeth all arrive Brinker says he will have a grand celebration and test out the molars in the most approved way."

So the endocrinologist bids fair to render the prosthodontist useless, and by the same token exits the exodontist. Dentistry becomes a neglected art—a useless profession.

*Enter the Endocrinodontist.*

*Dr. Clinton C. Howard, Atlanta, Georgia.*—I do not understand why I was selected to discuss this paper unless it was the fact that I have been deeply interested in this subject. I have been a student of endocrinology and its various windings for two or three years. In the study of this subject I have had the collaboration of Dr. Arch Elkin, of Atlanta, an endocrinologist and several pediatricians. The subject in some of its phases has been very peculiar and certainly very vague to me, and for that reason I might present a few points in connection with this phase of medicine which must have, I believe, considerable to do with metabolism and the study of the mouth from a glandular standpoint.

We, as orthodontists, cannot help but be interested in metabolism in general because of the fact that we have passed that state of reasoning; that state of analysis on our part which is confined purely and solely to the mouth. We have now gotten to a point where we do not consider any longer the mouth as an entirely separate proposition as far as the organism is concerned, but we must consider it more as a part of general metabolism.

If the premise taken by the endocrinologist is true, we must be interested in endocrinology.

I took the liberty of copying a chart which in a certain sense is a classification of these cases and is partly the result of the work done by Dr. Engelbach, of St. Louis, whom I am pleased to know is a friend of Dr. Timme's. Dr. Engelbach does not take the thymus gland as a basis in producing certain abnormalities as much as he does the pituitary gland. At the same time, in justice to him, I will say I am sure he fully recognizes the interdependence of all known glands in the endocrine system. That brings up another study so far as the medical world is concerned. Physicians feel sure that only a small part of these particular glands have been discovered and understood; that there may be other glands that have never been seen or tissues which act and functionate along the lines of the endocrines which influence metabolism which have not been discovered, and this brings me to this one thought; these glands may be influenced one by the other, and that one gland may create a certain manifestation peculiar to itself, due to an imbalance of a remote gland. We do not know of all of these glands and the particular functions they may carry on, and the result or manifestations we assume to be correct today may not be correct at all.

I should like to call attention to the anterior lobe of the pituitary body and what Dr. Engelbach believes occurs when there is imbalance of this gland. An imbalance though correlation or specific may produce, as explained by Dr. Timme, a possible deficiency of the thymus. At any rate, Engelbach has seen these things manifested in the anterior lobe of the pituitary gland where we have, on the one hand, hypersecretion and on the other hand hyposecretion. This is a report of 350 cases (referring to chart) along this line. He has a report of 650 cases not dealing with the pituitary body. The hands are larger than normal

with no disproportion. The distal phalanges probably tuft as can be clearly demonstrated by means of the x-rays. The hair distribution is increased.

Let us take over here (illustrating) the preadolescent care, the care of hyposecretion, in which all the bones are under developed. The head is small; the sinuses are small. The hands are very much smaller than normal, and so on. It is just the reverse, so to speak, of what you might have expected to find.

Another thing is with reference to Dr. Engelbach's theory. If he finds disproportion of the skeleton system, and certain manifestations which he believes are dependent on these particular glands and they show marked signs of improvement under glandular treatment, as orthodontists, we must be vitally interested.

My ambition as a discusser of this paper is to try to stimulate you men to pay more attention to the organism as a whole, and certainly to pay more attention to the organism as influenced by this wonderful, most mysterious group of glands. The question arises in my mind whether we have arrived at the point wherein we can take certain known symptoms or certain markings and couple these markings with a certain classification of malocclusion. That would be interesting work for some one to do. It would take long application and study to accomplish it. It may take a thousand cases or more carefully studied, showing the disproportions in measurement of each case.

To go further, I saw one case go through endocrine treatment. The patient was a young man, 17 years of age, who was sent to Atlanta to be treated by an orthopedic surgeon for failure of the epiphysis of the hip joint. He came to Atlanta walking on crutches. This young man went to one of our foremost orthopedic surgeons in the country (Dr. Michael Hoke) who decided it was not a case for his work at all. He referred the case to Dr. Elkin, who is quite a student of and worker in endocrinology. He took the boy and attempted to type him. The boy showed unmistakable signs of pluriglandular insufficiency and went under endocrine treatment. This boy was generally obese. His mammary development was strikingly that of a female. So far as hair in the pubic region was concerned, there was practically no hair. This applied also to the axillary region. He had a disproportion in measurement of five inches; the torso being shorter than the long bones.

There is another thing I would call attention to, namely, these cases, as pointed out by Dr. Timme, differ. He had no sign of hair or of hair growth on the face. He had also never had any sexual desire. He was not considered a thymus subject, although no one knows but what there may have been an interdependence between the pituitary and the thymus. Dr. Elkin may have the right idea that this is distinctly an endocrine "clinic" shown in one case affecting particularly the pituitary and gonad systems.

The thymus gland at the age of twelve or fourteen in most cases is considered normal in normal individuals. It does disappear. This boy was given hypodermically 2 c.c. of pituitrin, every twenty-four hours. He got up to that point and received 60 grains by mouth a day, in addition. This was carried on for six months, using the posterior lobe extract, and finally he was given anterior lobe extract. In nine months time the change that took place was very evident from the picture shown. Sexual desire was completely changed toward normal. He was embarrassed in having the picture made. The hair distribution, instead of being effeminate, is becoming masculine. Hair distribution has markedly increased under the axilla. You recognize the effeminate girdle here and the loose hips. All of them will show in the next slide quite a change under endocrine treatment. Of course, one such case means nothing, but, I am showing this one picture to impress upon you the disproportion of the general skeleton make-up.

This fellow (showing slides of another case) was suffering from kyphosis or curvature of the spine, which may have some influence so far as disproportion of measurement is concerned. He had a disproportion of nine and a quarter inches, the long bones being increased. We speak of individuals as normal as we have done in the past, and when we speak of such a thing as normal individual we may be able some day to step beyond that and say when an individual is normal or has a pathologic condition from the standpoint of endocrine influence on general metabolism.

Here is a young man with a type of case we often see. I am showing this to point out that members of the orthodontic profession may actually diagnose this condition. If you know anything about the case, you may easily differentiate between local and general conditions. Has endocrinology anything to offer us from the standpoint of analysis which we can depend on so far as analyzing these conditions of malformed jaws?

It is my contention that at the age of six or seven, allowing for variation so far as eruption is concerned, these anterior teeth come in and take their places. It must be assumed, in another group of cases that between birth and the age of six or seven the arches or jaws have developed sufficiently large to take care of these teeth. If you look at the hands you can see that they are more or less symmetrical; the teeth are more or less symmetrical; the general skeleton is more or less symmetrical, and you cannot say that he is underdeveloped, but any man who looks in the mouth sees that the arches are not big enough to accommodate these teeth, and he is bound to say that something is wrong.

From the standpoint of the relationship between endocrinology and orthodontia we have something more definite than any markings that the endocrinologist has. One can see that some maldevelopment has taken place.

Dr. Timme mentioned tardiness in the eruption of teeth. There is a variation of two or three years, and we know it. I have seen in our cases and cases in the hands of pediatricians where the first disproportion failed to show itself at the age of fifteen months, with a great many other markings that go with it. That is interesting from the standpoint of orthodontia.

Let us take our cases of infraclusion. There are those who attribute these conditions of imbalance to certain groups of glands of the endocrine system.

Dr. Timme spoke of the size of the teeth. I am afraid what he said in this regard will be misconstrued. After the teeth are once laid down in the crypts and their shape and size have been already determined, and the mineral matter has been deposited, he surely did not mean that these teeth will grow and change. A tooth does not change after it is once calcified. Therefore, the endocrines cannot have anything to do with it. The shape and size of these teeth may be determined in the formation of the central incisors which are laid down one year after birth. At the age of seven or eight these incisors may undergo disturbance or imbalance at that time, but they do not change after they were laid down in the crypts. If you will allow me to make a prediction, I am going to say to Dr. Timme that the time is coming when the orthodontic profession will unquestionably think of disproportions of the entire structure. They will think of the hair distribution, the character of the hair, the skin, the disproportion in the long and short bones, etc. And it is rather interesting to think of that particular group shown in the chart the doctor has mentioned that I will describe from an embryological standpoint as being derived from one distinct layer of the ectoderm. That is significant in itself. To both of us, if we find these particular markings in general we may suspect a condition of malocclusion and that case might be correlated and stuck away so that we can pick up a chain of many links in the future, all of which concern maldevelopment, and still we can only pick out the teeth as one link and attempt to make the correction. If our profession is broadened, I am sure it will depend on the efforts to a great extent of such men as our guest, Dr. Timme.

*Dr. Timme* (closing).—It is hardly necessary to close the discussion when friends have taken such good care of you. They will insist on protecting me, for which I am thankful, and at some future time I hope to reciprocate.

Dr. Howard's remarks interested me exceedingly, and I am quite sure that if the members of this Society will follow him in their work and try to parallel it there will be no necessity for men working in my field to address you. He seems to have grasped the subject very intelligently and to have pointed out the fact that it is essential in order to broaden the field of all types of medicine to understand the constitution of the patient, broadly speaking, rather than one particular isolated point of contact—his symptoms.

I have nothing to say regarding any criticism he has made, if he has made any. As to the change of formation in the size of a tooth after it is laid down in the crypt, if in

my previous remarks I conveyed the idea that there is a change in size and form after it is laid down in the crypt, it is my mistake, for after it is once laid down in the crypt the form probably does not change. There can be absorption of bone later but the original form remains.

I want to thank Dr. Howard for presenting those aspects of the subject which are of interest to those engaged in his own field of work. That presages a wonderful advance.

As far as the remarks of Dr. Stearns are concerned, I shall not attempt to gild gold or paint the lily.

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## ORTHODONTICS: THE BEARING OF ETIOLOGY ON TREATMENT*

By Harold Chapman, L.D.S. Eng., D.D.S. Penn. (of London)

"THE amount of growth in a bone depends upon the need for it" (Wolff's "Law of Bone Transformation," as expressed by Murphy).

"In all static deformities (of bone) the transformation of bone is a direct result of defective or unbalanced muscular action" (A Keith, "Menders of the Maimed," p. 283).

"Classification of Abnormalities of Position" (Norman G. Bennett).

"II. Abnormal formation of a part or the whole of either arch due to **developmental defects of bone**" ("Dental Surgery," edited by Norman G. Bennett).

One thing Prof. Fawcett told us yesterday afternoon—that muscle tension was a factor in the development of bone in the fœtus—coincides with the ideas I wish to present to you this morning, except that I ask you to consider the individual a little later in its existence.

### 1. ORIGIN OF THIS PAPER

To appreciate the connection between etiology and treatment, which I wish to bring to your notice, I shall have to devote much of this paper to etiological factors, and then it will be simple to pass on to consideration of the bearing this has on treatment; in fact, it will become self-evident as the paper proceeds.

During the last few years I have been approached several times with a view to writing a paper on the etiology of irregular teeth. My reply has always been that I had no knowledge of the subject; that is true today, but I have some ideas about it which I have thought fit, wisely or unwisely, to put before this meeting. I ask those who have requested a paper from me on this subject in vain not to feel hurt; had I been told six months ago that I should read such a paper here today I would have replied "Absurd." I regarded it not merely as improbable, but as impossible. May I just tell you how it has all happened? Just over a year ago I asked a friend, who is also an orthopædic surgeon, to recommend me a small textbook on ortho-

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*Read at the annual meeting of the British Dental Association at Bath, on June 24, 1921. Reprinted from *The British Dental Journal*, September 15, 1921.

pædics. In reply he handed me Sir Arthur Keith's "Menders of the Maimed," which I found to contain some of the information that I was in need of. This paper is the combined result of reading a few pages in that book, of recent communications to the British Society for the Study of Orthodontics, of thoughts which have evolved as a result of the preparation of lectures on orthodontics for the students at the London Hospital Dental School, for in two successive courses the lectures are rarely the same, and of articles on "Muscle-training and Orthodontia," by Rogers, of Boston.

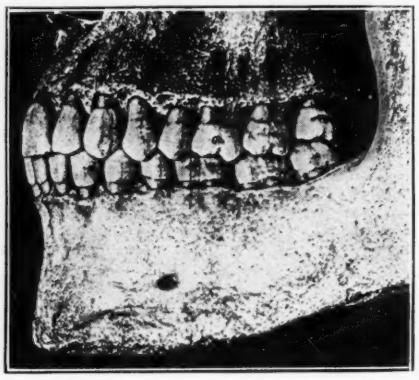

Fig. 1.

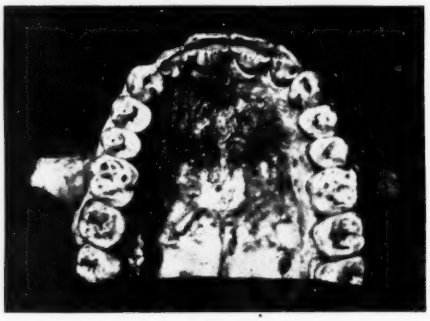

Fig. 2.

Fig. 1.—Normal occlusion. N. B. the length of the arch, the vertical development and the overbite, the maxillary incisors not overlapping more than one-third of the mandibular incisors.

Fig. 2.—Normal maxillary arch. Occlusal view. N. B. the breadth of the arches and the wear on the six front teeth caused by the corresponding mandibular teeth. Particularly notice the position where the mandibular incisors have occluded with the maxillary incisors and that this position is well away from the gingival margin; this clearly shows the amount of overbite.

Fig. 3.—Normal mandibular arch. Occlusal view. This is the mandibular to the maxillary shown in Fig. 2.

It is essential to realize that irregular teeth have no connection with teeth *per se*—they may be perfect as teeth, just as in a case of strabismus the eye may be perfect but its muscular or nervous mechanism is at fault. Irregular teeth are the expression of imperfect bone development; it is one of the duties of an orthopædic surgeon to treat bone deformities, hence the request to my friend.

You will be able to find exceptions for everything I say, so I request you to take a broad view of this subject and to dismiss minor and relatively unimportant details, also more or less rare pathological conditions.

I want you to think only of a simple abnormality, if I might use such

a term, and not of an abnormality in which abnormality has been heaped upon abnormality to produce a tangle that would only serve to baffle instead of help us. I should add that I have in mind cases of irregularity in which all the teeth are present. Class II of Bennett's classification of irregularities answers the purpose exactly: "Abnormal formation of a part or the whole of either arch due to *developmental defects of bone,*" or Angle's Classes I and II which include the same irregularities and are typical of those most frequently met with. (Figs. 1-7.)

Fig. 4.

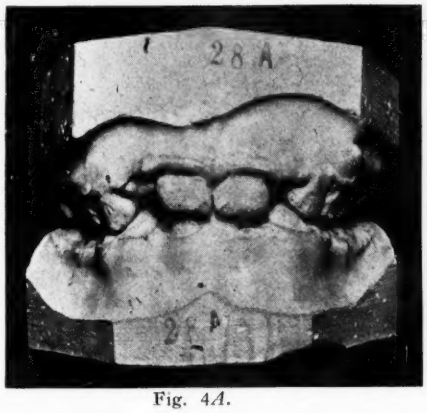

Fig. 4*A*.

Fig. 5.

Figs. 4 and 5.—Example of Angle's Class I. Normal mediodistal relation of the arches. Both arches are too narrow and too short.

Fig. 4*A*.—Front view in occlusion of Figs. 4 and 5, showing normal vertical relation of maxillary and mandibular incisors, but probably there is also underdevelopment in this direction as well as laterally and anteroposteriorly.

The problem is sufficiently complicated and difficult without making it more so; I do not wish to consider cases where teeth are missing, or cases of irregularity due to local causes, as given in Bennett's Class I. We are told of various factors that may cause irregularities of the teeth such as lack of vitamines, abnormality as regards internal secretions and so on. But there is one factor, the importance of which I venture to suggest cannot be impressed on us too often. It is a factor that is more than likely to come into play in

the case of every dentition (and these irregularities are so common, a few types but many variations, that there must be a common cause, one that affects only the jaw and associated bones, at work to produce the majority of them) whether, in addition, vitamines, internal secretions or other factors have a share in the responsibility. The factor is muscle action that is not normal, with resulting abnormality of bone, which in its turn results in irregular teeth. Irregularities of teeth due to developmental defects of bone are the cases which I ask you to consider; to find the cause of irregular teeth

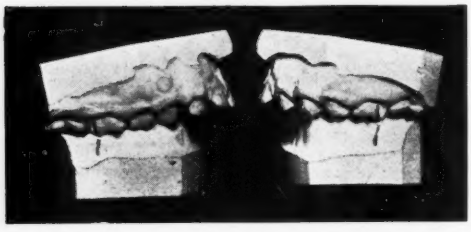

Fig. 6.

Fig. 6*A*.

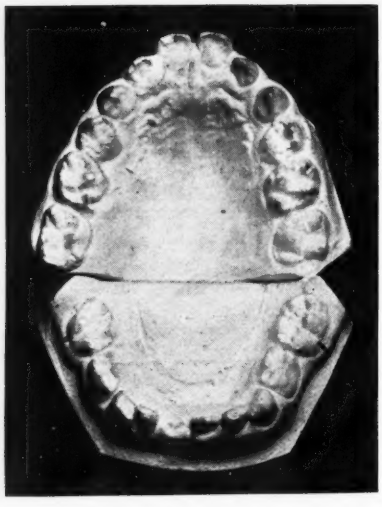

Fig. 7.

Figs. 6 and 7.—Example of Angle's Class II. Mandibular arch distal in its relation to the maxillary arch. Maxillary arch is too narrow and too long (deformation of the maxilla.) Mandibular arch is too narrow and too short. Vertical development abnormal, as shown by excessive overbite.

Fig. 6*A*.—Front view in occlusion of Figs. 6 and 7, showing abnormal vertical relation of maxillary and mandibular incisors, the result of unequal vertical development in the incisors and molar regions.

we have to seek the causes of bone defects, of which the teeth are but the expression. If, when we are asked our opinion on an orthodontic case, we looked at the teeth and then translated what we saw into terms of maldevelopment of bone, I venture to suggest we should enter on treatment with a somewhat less hopeful view of prognosis. That is what I want to do in regard to these irregular teeth; let us endeavor to make teeth secondary in our minds, and primarily concentrate on what the bone maldevelopment may be. It is reminiscent of what was on our money boxes when we were

children: "Take care of the pence and the pounds will take care of themselves." We must not consider, to the exclusion of more important matters, irregularities of individual teeth; for example, whether a lateral be instanding or outstanding is a minor affair; it is just as easy to move such outwards or inwards. (Figs. 8 and 9.)

### 2. WHY TEETH ARE IRREGULAR

Why are teeth ever irregular? (By "irregular" is meant a deviation in alignment or occlusion from the normal.) Because the bones are either not the correct shape or size, or these combined, to contain all the teeth in correct alignment; frequently the jaws are too small for this to be possible. Why are not the teeth correctly correlated to the jaws as (say) the head of the humerus to the glenoid cavity of the scapula, or the condyle of the mandible to the glenoid fossa of the temporal bone? In this connection it is the size

Fig. 8.

Fig. 9.

Fig. 8.—Outstanding maxillary laterals.

Fig. 9.—Instanding maxillary laterals. The causes of such an irregularity as this and that shown in Fig. 8, are probably the same; treatment is the same except as regards the direction of movement.

of the teeth that is all important; it is conceivable, but improbable, to have teeth so small that they might be arranged in good alignment in the smallest adult maxilla.

### 3. SIZE OF TEETH UNAFFECTED BY POSTNATAL CONDITIONS

So as not to complicate the matter unnecessarily let us think of the size of each tooth as regards its width (it is width which makes the teeth palpably too large for the jaws) at three months after its calcification begins, for then the widest portion of the tooth is fully formed. In the case of all the deciduous teeth this factor is settled before birth; in the case of the permanent teeth it occurs at birth in the case of the first molar and at four months of age for the central; at 2 years for the lateral, at 4 years for the canine, and at 5 or 6 years for the premolars. (Fig. 10.)

From these facts we may say that the width of all the teeth erupted before the age of 12 is fixed before or soon after birth, except in the case of the permanent lateral, canine and premolars, and in these it is fair to assume that their width is unaffected by postnatal conditions, i.e., the work they have to do.

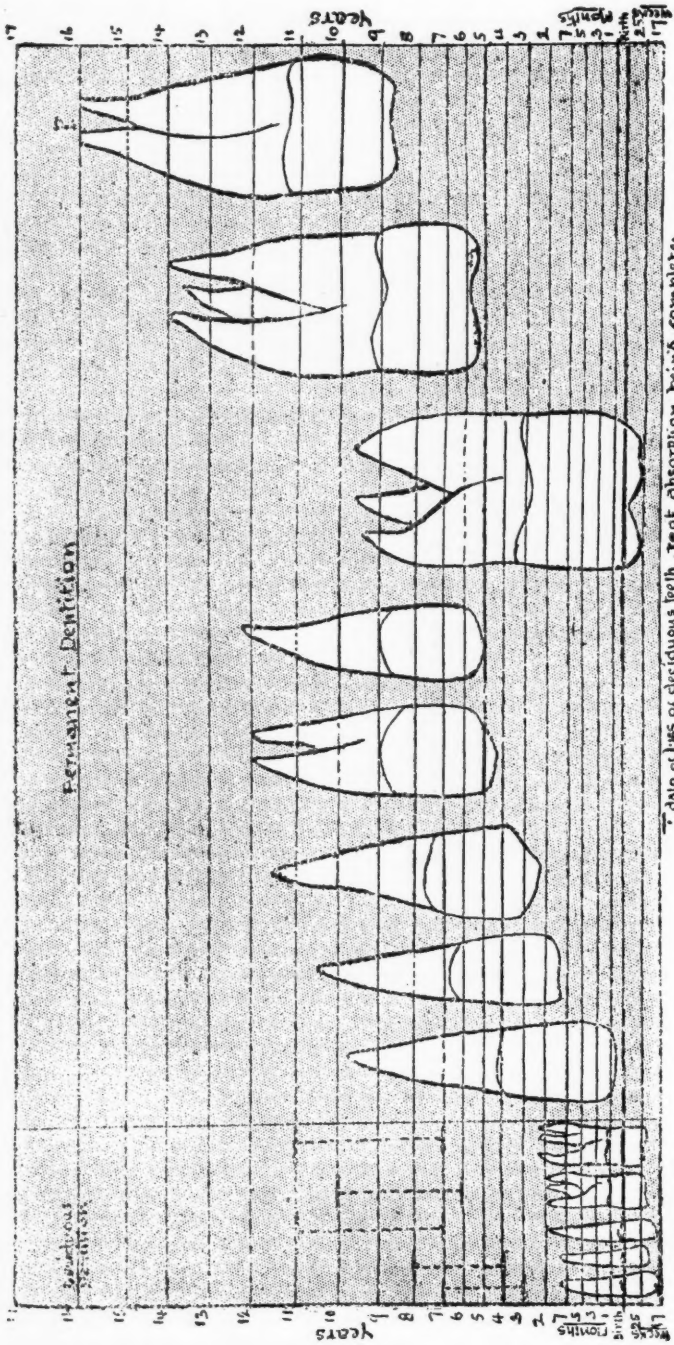


Fig. 10.—A didactic table of the calcification, eruption, etc., of the human teeth by Dr. Leon Frey (from L'Odontologie, April 30, 1921, and the Dental Record, October, 1921).

## 4. SIZE AND SHAPE OF JAWS AFFECTED BY POSTNATAL CONDITIONS

But what of the jaws? Here we have an entirely different problem, if we accept what we are told in "Menders of the Maimed." In the case of the

maxilla and mandible, in addition to the bones proper, we have the alveolar process, a process of bone which is dependent on teeth for its existence and serves as a connecting link between the jaw proper and the teeth. In order not to confuse the issue I shall not refer to the alveolar process again; in fact, I find no necessity to do so, for where teeth are there must be alveolar process to attach the teeth to the body of the bone. Therefore, the shape and size of the arches of teeth at their necks are also the shape and size of the bone to which the teeth are attached; local influences, e.g., excessive overbite, may also affect the former.

While it is true of the majority of bones that the amount of growth depends upon the need for it, if we include in "the need for it" in the case

Fig. 11.

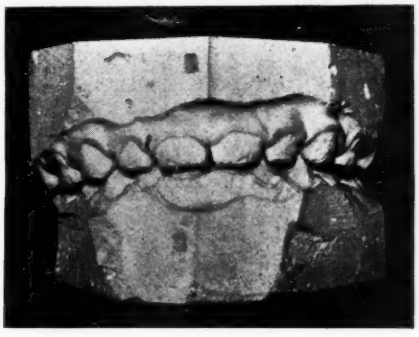

Fig. 12.

Fig. 11.—Normal occlusion and growth at 4 years of age. Left side in occlusion. (Figs. 11 to 16 are all of models of the same individual.)

Fig. 12.—Normal occlusion and growth at four years of age. Front view in occlusion. Notice the spacing of the incisors and normal vertical relationship of maxillary and mandibular incisors.

Fig. 13.

Fig. 13.—Normal occlusion and growth at four and eight years. Right side in occlusion. Notice the growth anteroposteriorly.

of the jaws, the proper alignment of the teeth, this is not true; teeth are not the cause of correct jaw development. Of the many causes suggested the one I wish to deal with is proper functional use, i.e., the thorough mastication of food demanding great muscular activity, and the reverse of this. Thorough mastication is essential to the development of the bones to which the muscles of mastication are attached. There are authorities who tell us teeth are unnecessary today as organs of mastication because one can live on a diet not requiring mastication, and as there is a greater and greater tendency to do so we must expect to see numbers of jaws too small to contain the teeth in good alignment. We may presume that the jaws, if they function normally, will develop to a size that will accommodate the teeth in normal occlusion;

in other words, the size of the jaws is affected by postnatal conditions, i.e., they are affected by the work they have to do: whereas, as has been pointed out, teeth are not so affected. Any abnormal functioning of the factors which cause abnormality in bone growth is bound to show itself in abnormality of occlusion of the teeth in proportion to that abnormal functioning. Therefore, it is evident that the development of normal occlusion is a very delicate

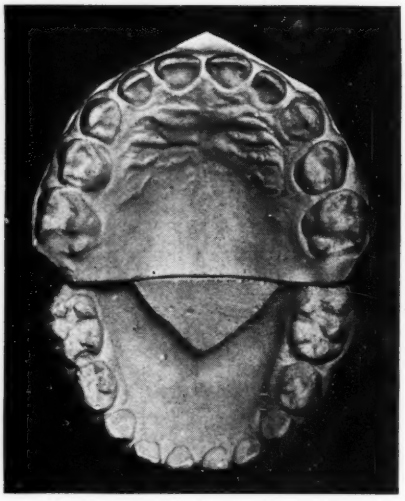

Fig. 14.

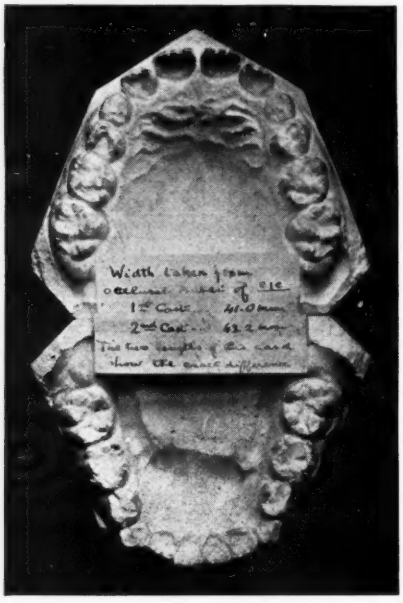

Fig. 15.

Fig. 14.—Normal growth at four years. Maxillary and mandibular occlusal views.

Fig. 15.—Normal growth at eight years. Maxillary and mandibular occlusal views. N. B. increase in width of the arches of two mm. during the last four years.

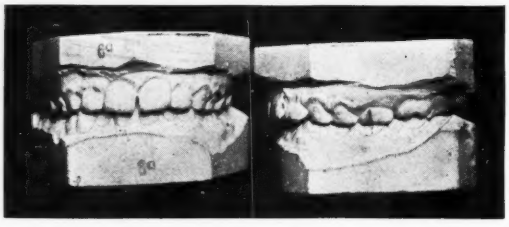

Fig. 16.—Normal occlusion and growth at eight years. N. B. normal vertical relations of maxillary and mandibular incisors. (Figs. 11-16 from the transactions of the British Society for the Study of Orthodontics, 1910 and the Dental Record, 1915.)

process, and one that may easily be disturbed; any such disturbance will be made evident in the position of the teeth. I shall endeavor to emphasize that point when we come to deal with articulation. Unfortunately, teeth not in good alignment are a marked disfigurement and patent to all more often than not, whereas a corresponding deficiency in growth in another bone would escape all but the expert eye seeking for deformities.

### 5. DIRECTIONS OF GROWTH OF THE JAWS

There are three directions in which the jaws grow:

(1) Anteroposteriorly.

(2) Laterally.
(3) Vertically.

The development in the first two directions may be judged by the shape and size of the arches, i.e., the alignment of the teeth. The vertical development is more difficult to diagnose; this may be impossible if it is symmetrically fully developed or underdeveloped. If there is unequal or unsymmetrical vertical development in different parts of the bone then this will be observable in the occlusal plane of the teeth, and readily seen perhaps by looking at the maxillary or mandibular casts individually and certainly when they are occluded; photographs may help diagnosis.

### 6. TWO DISSIMILAR RELATIONS BETWEEN MAXILLA AND MANDIBLE

The relations of the maxilla and mandible to one another are also dissimilar to the relations of any other bones; their relations are two, very dissimilar in kind: (1) the articulation of the temporomandibular joint; and (2) the occlusion and articulation of the teeth. The development of the joint articulation is as in other joints, but the development of the dental articulation will depend on various factors operating locally.

### 7. NORMAL GROWTH OF BONE DEPENDS ON FUNCTION

Normal growth of bone, as of other structures, depends on function. This rule applies to the maxilla and mandible, but they are dissimilar to any other bones as regards function; the functions they subserve include mastication, deglutition, speech and respiration (Bennett, p. 30). The first and last functions will receive further notice.

Bone growth is due in the case of the jaws to:

(1) An inherent ability to grow.
(2) Muscular action:
    (i) The use of muscles attached to the skull and parts other than the mandible.
    (ii) The use of muscles attached to the mandible and other parts, especially muscles used in alimentation. These are subdivided into:
        (*a*) Muscles used before the eruption of teeth—birth to 9 months for natural sucking,
        (*b*) Muscles used after the eruption of teeth—9 months onwards for tearing, grinding and crushing.
(3) Nasal breathing.

If these factors for growth are not sufficiently and correctly used and correctly balanced, abnormal occlusion may be anticipated.

Why do I suggest that abnormal occlusion may be anticipated? Because there are two articulations between the maxilla and mandible which are quite separate and entirely different from one another. The articulations are (1) the temporomandibular; and (2) the teeth. The former is a ginglymoarthroidal joint, with its parts in constant relation, but articulation in the second only occurs as a result of muscular action, and is of a transient char-

acter. The articulating parts are not held in constant contact, and when contact is effected it may vary considerably on account of the nature of the temporomandibular joint; its development is a thing apart from the development of the joint proper, and the effect of its development on the face is so great that it has received considerable attention.

From the quotations made at the outset it may be inferred that I wish to make the point that bone growth is due to muscle action only; such is not

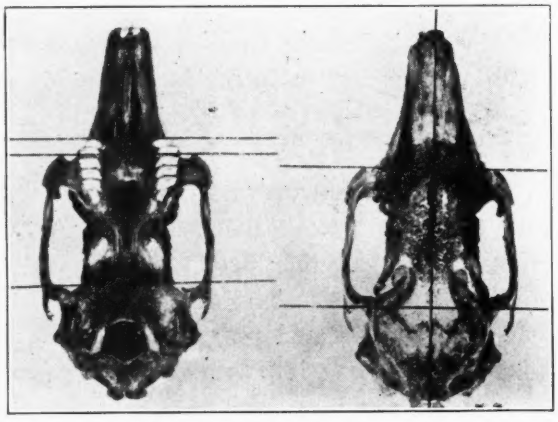

Fig. 17.—Skull of a normal rabbit (control for Fig. 18). (A preliminary Study of the Influence of the Forces of Occlusion on Development of the Bones of the Skull. By Dr. Baker, of Boston. Items of Interest, 1911, xxxiii, 110, Figs. 7 and 8.)

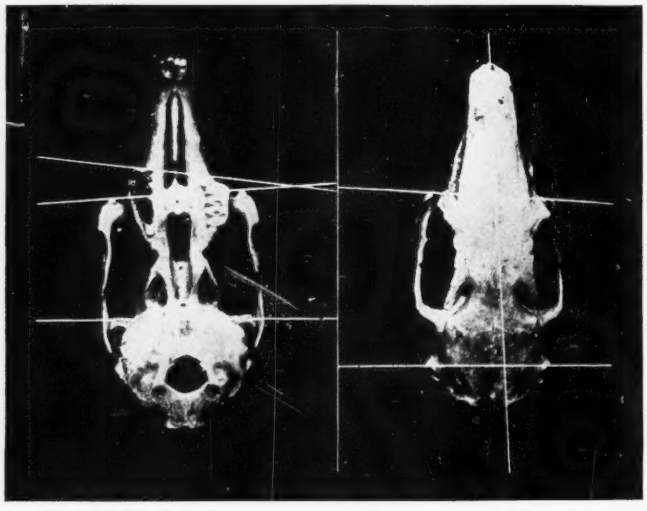

Fig. 18.—Skull of a rabbit whose teeth on the right side were rendered functionless. N. B. the underdevelopment of the entire skull, face included, on the functionless side. (Items of Interest, 1911, xxxiii, 110, Figs. 5 and 6.)

the case, but I do wish to lay stress on the point that normal muscular action is an important factor in the development of normal occlusion that has not received the attention that it merits.

### 8. MUSCLE ACTION AND BONE GROWTH

The second cause of bone growth will now receive consideration. Baker, of Boston, has shown that disuse of the teeth on one side considerably affects the development on that side of the bones of the head and face, both in

length, breadth and height. This was proved experimentally in the case of young rabbits whose teeth on one side were rendered functionless by grinding. (Figs. 17 and 18.)

On examination of a muscular dissection of the cranium and face it is found that there are ten groups; I mention only three of them and the muscles included in them.

The three groups and their muscles are:

(1) Intermaxillary region:

Buccinator; orbicularis oris.

(2) Temporomaxillary region:

Masseter; temporal.

(3) Pterygomaxillary region:

External pterygoid; internal pterygoid.

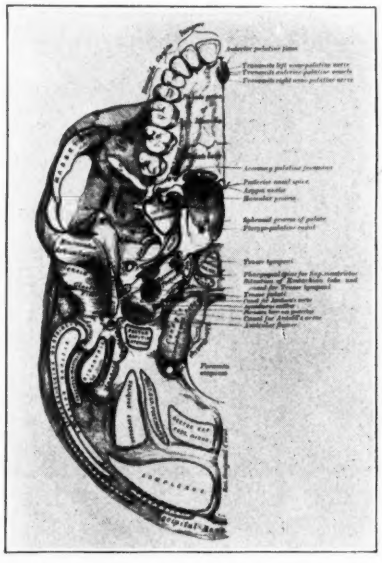

Fig. 19.—Base of the skull. External surface. (Fig. 183, Gray's Anatomy, 14th edition, London, 1897.)

But there are other muscles, those of the neck, which are in close relation with parts to which the muscles just mentioned are attached.

The muscles of the neck are arranged in nine groups; I will mention only five of them and their more important muscles.

(1) Superficial region:

Platysman myoides; sternocleidomastoid.

(2) Supra-hyoid region:

Digastric; stylohyoid; mylohyoid; geniohyoid.

(3) Lingual region:

Five muscles.

(4) Muscles of the pharynx:

Five muscles.

(5) Muscles of the soft palate:

Five muscles.

Because some groups and many muscles are omitted from this list I would not have it inferred that they are of no importance; the more important ones

only are included as they are sufficient for the purpose, and of these I shall confine myself in this paper to those in closest connection with the parts that interest us.

One would like to take each muscle separately, discuss its action and the effect of that on bone development, but that is impractical at this meeting, so I will discuss these muscles not as grouped above, but grouped according to their attachments. It will be observed that the glenoid fossa is surrounded by powerful muscles, all attached to the anterior two-thirds of the skull, but their influence on bone growth is not thereby limited exactly to the area of their attachment.

(1) Glenoid fossa region:

Temporal: above and external to the glenoid fossa.
Masseter and buccinator: in front of the glenoid fossa.
Digastric and sternomastoid: behind the glenoid fossa.
Internal pterygoid and external pterygoid: internal to the glenoid fossa. (Fig. 19.)

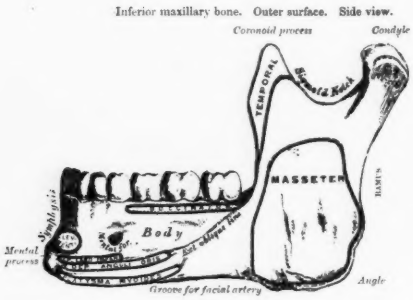


Fig. 20.

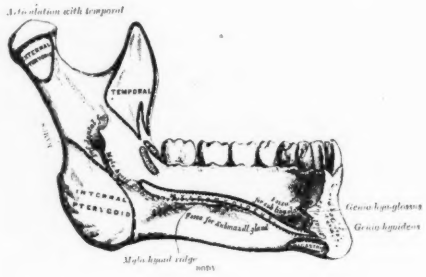


Fig. 21.

Fig. 20.—Inferior maxillary bone. Outer surface. Side view. (Fig. 176. Gray's Anatomy, 14th edition, London, 1897.)

Fig. 21.—Interior maxillary bone. Inner surface. Side view. (Fig. 177, Gray's Anatomy, 14th edition, London, 1897.)

(2) Maxillary region:
- (i) Orbicularis oris.
- (ii) Buccinator.

(3) Posterior mandibular region:
- (i) Masseter.
- (ii) Buccinator.
- (iii) Temporal.
- (iv) External pterygoid.
- (v) Internal pterygoid. (Figs. 20 and 21.)

(4) Central mandibular region:
- (i) Mylohyoid.
- (ii) Buccinator. (Figs. 20 and 21.)

(5) Anterior mandibular region:

Externally: orbicularis oris; platysma myoides.
Internally: digastric; geniohyoglossus; genioglossus. (Figs. 20 and 21.)

In this last grouping I have enumerated all the muscles of importance attached to the anterior two-thirds of the skull and face; every one of them except the sternomastoid is a muscle of alimentation; several are muscles of deglutition. Perhaps the sternomastoid should not have been included, but it serves to show that no one group of muscles is independent; in any case it has less bearing than any of the others on our problem, which is a consideration of the development of the upper and lower jaws, parts which are considerably anterior to the attachment of this muscle. Therefore, if there is any truth in the law that "The amount of growth in a bone depends upon the need for it," we shall expect the area in every direction from the glenoid fossæ to be well developed or badly developed according as the stresses during mastication on the bones about these fossæ are sufficient or insufficient, and it must not be forgotten that this development takes place antero-posteriorly, laterally and vertically. Can it be doubted that mastication has a very marked effect on the development of this region in all three

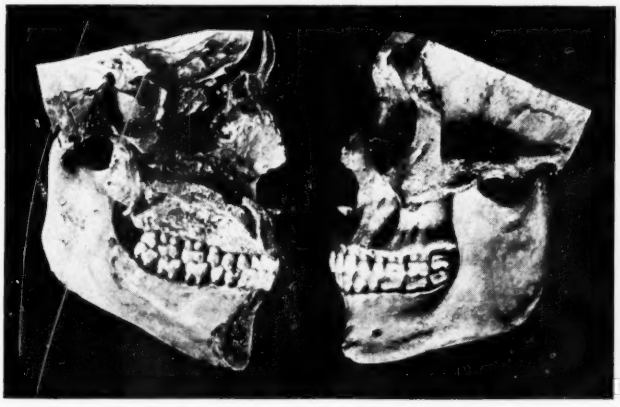

Fig. 22.—Lateral view of a skull; internal and external views; to show the close connection between the sphenoidal and zygomatic regions to the maxillary and temporomandibular regions.

directions? In close relationship with the development in the region of the glenoid fossa there is also the development of the zygomatic process of the temporal bone, the malar bone and the malar process of the maxilla, the three parts forming the zygoma, to which the masseter is attached; reference is made to this because the maxillary root of the zygoma varies in its relation with the teeth at different ages; again, the pterygoid muscles are attached to the external plate of the pterygoid process of the sphenoid and a part of the temporal muscle is attached to the greater wing of the same bone. (Fig. 22.) If it be true that "the amount of growth in a bone depends upon the need for it," the more we examine the attachments of the muscles of mastication the more important this function of the teeth becomes in developing the bones of the head and face,[1] and the more it must have an effect on the growth in all three directions of the maxilla and mandible, even if it be only to the extent of a millimeter or two in the width and length of the dental arch, for this is sufficient to make the difference between a set of teeth in good alignment and one in which the teeth are arranged irregularly.

[1]Sim Wallace refers to this in "The Irregularities of the Teeth," Chapter V.

If one examines a mandible at three months and another at eighteen months, one will see that an immense amount of growth has taken place during that period. (Fig. 23.) The full or correct use of the muscles of alimentation from birth is undoubtedly of the greatest importance if we are to get a full development of these bones. The growth of an infant is greatest in the first three months, so it is extremely important that all function should be accurate and full from the very beginning. (Fig. 23.) Another point is that the portion of the jaw to which the masseter is attached in the infant becomes, in the adult, the part which will be occupied by the molar teeth, and if these muscles do not function sufficiently to cause growth in that part at an early age, it is possible that the vertical growth here when the permanent molars erupt will be insufficient to give the correct height to the jaw, and

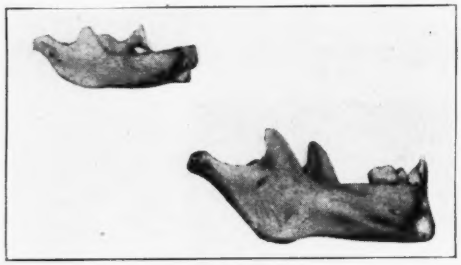

Fig. 23.

Fig. 24.

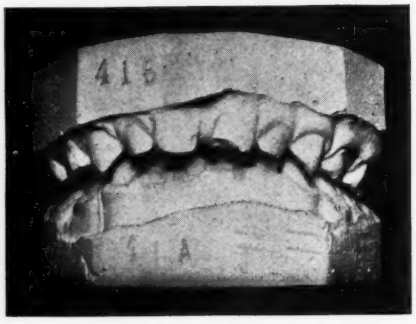

Fig. 25.

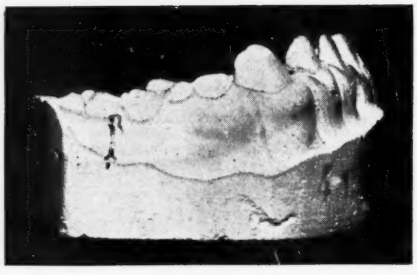

Fig. 26.

Fig. 23.—*A*, mandible at birth; *D*, mandible at 18 months. N. B. the large amount of growth in the first 18 months of life. (Fig. 1, Cryer "Internal Anatomy of the Face" 1st edition, Philadelphia, 1901.)

Figs. 24, 25, and 26.—To show lack of vertical growth in the mandibular molar region, as indicated by the overbite and the lower occlusal plane. This patient, age 4, is a younger brother of the case shown in Figs. 6, 7, and 26.

Fig. 24.—Right and left sides in occlusion.

Fig. 25.—Front view, in occlusion.

Fig. 26.—Mandibular model, right side.

therefore vertical abnormal occlusion (excessive overbite) in the anterior region will result. (Figs. 24, 25, and 26.)

A closer examination of this aspect of our subject is essential. If a child is fed naturally for nine months, one may conclude that the muscles, and the bones to which they are attached, used in accomplishing this, are properly developed—perhaps the orbicularis oris and the tongue are the most important agents, and we are left to the conclusion that the anterior part of the maxilla and mandible are properly developed, as it is in these

regions that the orbicularis oris is attached. After this period the child's diet is changed—or should be—to one which demands considerable muscular effort before it can be swallowed; and this is supplemented by the child's gnawing constantly any hard thing it can get into its mouth—i.e., the masseter, the temporal and the pterygoid muscles are coming into play, and with them the development of the ascending ramus of the mandible and the posterior third of the body of the mandible.

If these functions are naturally and normally carried out, normal mus-

Fig. 27.

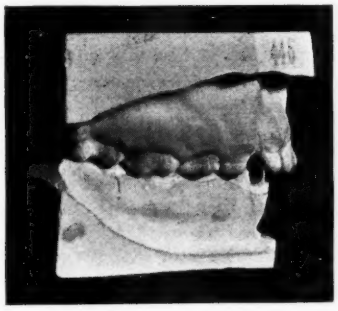

Fig. 28.

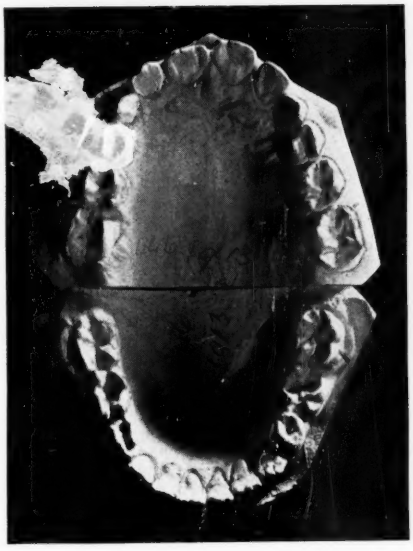

Fig. 29.

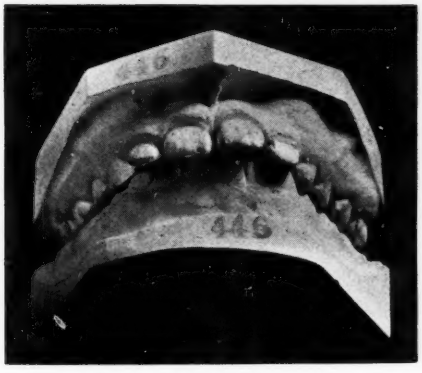

Fig. 30.

Fig. 27.—Case of Class I, showing lack of vertical development in (? mandibular) molar region, resulting in excessive over bite and forward inclination of the incisal edges of the maxillary incisors, making the maxillary arch appear too long. Both arches are too narrow; the mandibular is too short and perhaps the maxillary also.

Figs. 28, 29, and 30.—Class I case; the mandibular arch is very slightly posterior (not to the extent of half a cusp) in the molar region; the mandibular canines are each half a cusp distal. The mandibular incisors touch 2 1|2 at the neck where the hard and soft tissues meet; $\underline{|\,1}$ is too prominent to be in contact with the mandibular teeth. Age 8. Lack of vertical development in the molar region; probably largely responsible for the malocclusion.

Fig. 28.—Right side in occlusion.

Fig. 29.—Occlusal view; maxillary and mandibular. N. B. the well shaped mandibular arch; the narrowness of the maxillary arch in the canine region, and the forward inclination of the maxillary front teeth.

Fig. 30.—Front view in occlusion. N. B. excessive overbite and prominence of the maxillary front teeth.

cular action must be employed to perform them; these muscular actions will in turn cause a normal development of the bones to which they are attached, and as a result we may reasonably anticipate normal occlusion to result.

Unfortunately in many instances children are not fed naturally for the first nine months of their lives, and we have only to keep our eyes open as we go through the world to see that the diet of children is not of the Sim Wallace standard, which prevents not only dental caries but irregularities as

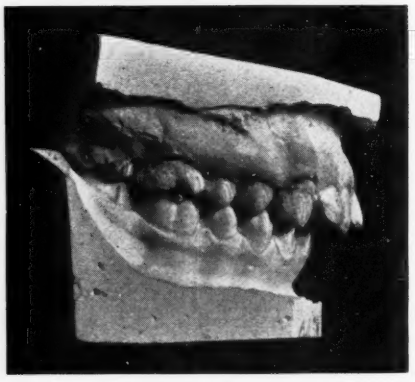

Fig. 31.

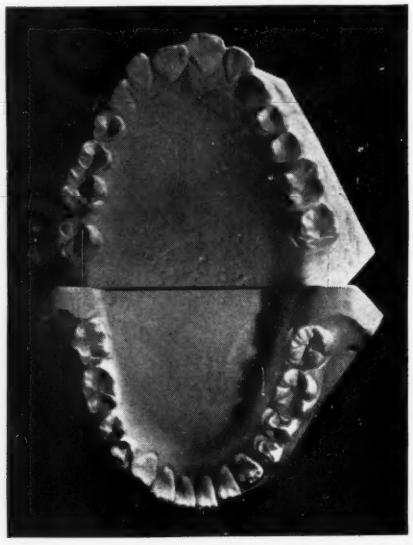

Fig. 32.

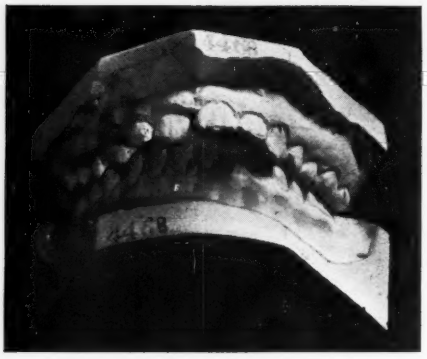

Fig. 33.

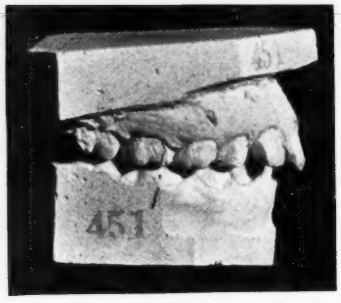


Fig. 34.

Figs. 31, 32, and 33.—Same case as Figs. 28, 29, and 30. Age 16, eight years later; the malocclusion has become worse.

Fig. 31.—Right side in occlusion.

Fig. 32.—Occlusal view, maxillary and mandibular.

Fig. 33.—Front view in occlusion.

Figs. 34, 35, and 36.—Class I Case. Age 9. Perfect arches, but lack of vertical development in the molar region, resulting in excessive overbite, which has caused prominence of the maxillary incisors.

Fig. 34.—Right side in occlusion.

well; I often wonder these have not been included in the title of his book on caries.

That irregularities are less observed in the temporary dentition than later may be due to the lesser opportunities one has for observing them, but it is

probable that in any case they are less numerous, because we may presume the jaws are normal at birth, and any effects of abnormal muscular action, a great factor in the production of malocclusion, may be expected to be less at 2 years of age than at 6 or 7 years of age, when the factor has been operative over a period at least four times as long.

### 9. BALANCED BUT INSUFFICIENT MUSCLE ACTION

Now let us suppose a case in which the muscles have all been at work, correct in proportion and kind, but the total work done has been insufficient. The jaws, as regards their various parts, will be developed equally but insufficiently, and these are the cases which fall into Angle's Class I or Bennett's Class II. There will be subnormal or underdevelopment antero-posteriorly, laterally and vertically, though the relations of the jaws to each other are otherwise correct; in other words there is a balanced subnormal development of bone. (Figs. 4, 4-A and 5.)

Fig. 35.

Fig. 36.

Fig. 35.—Occlusal view; maxillary and mandibular.
Fig. 36.—Front view in occlusion.

### 10. UNBALANCED MUSCLE ACTION

A more difficult phase of this problem in etiology now presents itself. Some muscle groups may have done sufficient work to produce the right amount of bone development in their particular area, but other groups may not have done sufficient, or again, others may have done too much, with the result that the growth of bone in different regions has not been correctly proportioned; the result of this is that the antero-posterior development in one jaw may be correct, but wrong in the other; or the vertical development may be insufficient in one or both jaws, or it may be sufficient in one area of one jaw and insufficient in another area of the same jaw; also there is the possibility of unbalanced lateral development in the two jaws; and again the abnormal occlusion resulting from these errors will act and react on the op-

posite jaw. It requires a better mathematician than myself to tell you how many varieties of irregularities are possible if the various errors in development which I have suggested are combined in every possible way. Bennett's classification will give you an idea of the number. We may consider one of them.

If the muscles function correctly in kind but not in correct relative proportion, then there results an unbalanced muscle activity with an unbalanced bone development, one result of which may be an excessive overbite in the incisor region brought about by insufficient growth vertically of the ascending ramus and in height of the body of the mandible in the molar region. (The part of the jaw, which is ascending ramus in the adult, was molar region say at 3 to 4 years of age, for the mandible grows by being thrust forward with deposition of bone on the posterior edge of the ascending ramus and absorption on the anterior edge.)

This insufficiency in growth vertically of the body of the mandible posteriorly and the ascending ramus may result from insufficient action of the muscles attached thereto, whilst the anterior regions of the jaws were

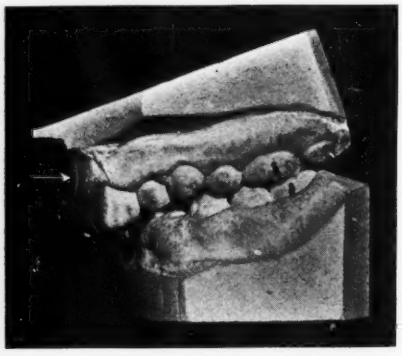

Fig. 37.

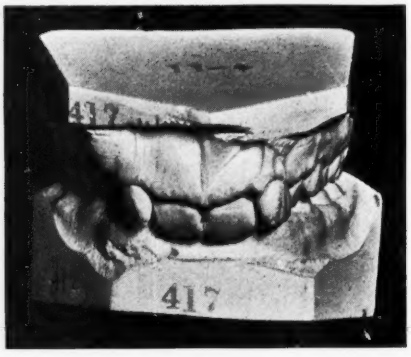


Fig. 38.

Figs. 37 to 42.—All of the same case and illustrative of the arguments put forth in sections 10 and 11 of the paper.

There is underdevelopment anteroposteriorly, laterally and vertically. The mandibular arch of teeth is in distal relation to the maxillary arch.

The vertical maldevelopment is not of the same degree throughout either the maxillary or mandibular arch; in the molar region of both maxillary and mandibular jaws it is markedly less than in the anterior portion of the corresponding jaw or arch; in the maxilla this is probably due to lack of vertical growth of the antrum.

Fig. 37.—Left side in occlusion; if the arrow were prolonged it would graze the incisal edges of the mandibular centrals. The tilt on the maxillary model is due solely to the overbite (of Fig. 39).

Fig. 38.—Front view in occlusion; the upper incisors cover an extent of the soft tissues as great as the length of the mandibular incisors (of Fig. 39—the faint horizontal line below the mandibular incisors indicates the position of the maxillary incisors in Fig. 38).

not subjected to any abnormal influence. Figs. 6, 6-A, 7, 24, 25, 26, 27 and 28 to 42 are examples of the effect of unbalanced muscle action in two Class II cases and three Class I cases, the latter being of three different types, Figs. 34, 35, and 36, showing that vertical underdevelopment may be accompanied by jaws otherwise normal.

### 11. GROWTH OF THE ANTRUM AND BONE GROWTH

In addition to the muscle influences in the development of the maxillary molar region, there is another factor at work in the general growth of this region and that is the growth of the antrum along the lower and posterior

borders of which the unerupted molars are placed. If there is insufficiency of growth of the antrum in all three directions, then a maxilla which is too short, too narrow and one without sufficient vertical height will result; this insufficiency of antrum growth is probably a result of imperfect nasal breathing as well as of muscle action. (Figs. 37-42.)

In these three examples:

(1) A balanced insufficiency of growth of maxilla and mandible.

(2) An unbalanced mandibular development so that the height of the molar region is insufficient.

(3) The effect of antrum growth.

Fig. 39.

Fig. 40.

Fig. 39.—Right side, mandibular only. N. B. the plane of the incisors is higher than that of the molars.

Fig. 40.—Front view; mandibular only. N. B. the plane of the incisors is higher than that of the molars.

Fig. 41.

Fig. 42.

Fig. 41.—Occlusal view, maxillary only; shows lack of development anteroposteriorly and laterally.

Fig. 42.—Right side, maxillary only. N. B. the plane of the incisors is lower than that of the molars.

I have endeavored to show how the growth of the jaws may be influenced by improper performance of the functions they subserve. It should be remembered that these three sources of error may be combined in one individual and that there are innumerable other irregularities and combinations of them, which would require too much time to work out etiologically now, but it is work waiting to be done, and I believe will offer ample reward to those who undertake it.

## 12. EFFECT OF ETIOLOGY ON PRACTICE

Now it only remains for me to draw your attention to the effect of the foregoing on current orthodontic practice. You will tell me that many cases

have been successfully treated without troubling about the factors I have just spoken of, but doubtless there have been numerous failures as well as successes, and it is with the object of reducing the number of those failures that I have been led to read this paper.

As an example, take the case of the child (6 years of age) whose models were shown first. Suppose that patient were treated at 12 years of age. It is conceivable, that by expansion of the dental arch—by that I mean the arch formed by the teeth—one could increase the width across the lower border of the mandible (Figs. 43 and 44-A and C), that one could increase the length of the lower border of the mandible from any given point, say the first permanent molar, to the mental process, and that one could increase the vertical height of the mandible; if one does these things then would not one also increase the width between the ascending rami and the condyles (Figs. 45 and 47) and of the temporal and sphenoid bones (Fig. 22); would not one increase the length of the mandible from the condyle to the mental process and increase the vertical height of the ascending ramus between the condyle and the inferior border? To carry the analogy further, one would increase the

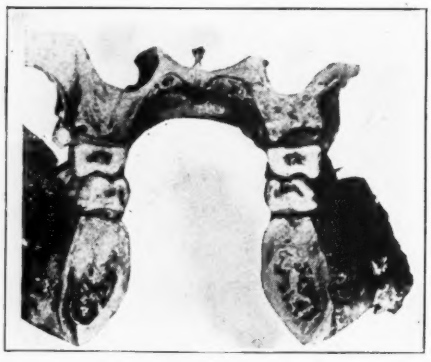

Fig. 43.

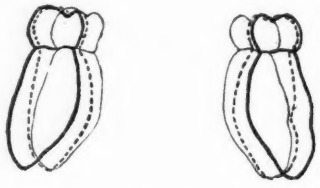

Fig. 44.

Fig. 43.—Vertical transverse section through the mandible and lower portion of the maxilla. (Cryer, 1st edition, "Internal Anatomy of the Face," Philadelphia, 1901, Fig. 149.)

Fig. 44.—*A.* Diagrammatic representation of Fig. 43, mandible only shown (of Fig. 45).
*B.* Diagrammatic representation of the same, after expansion of the dental arch, but without effect on the lower border or rami of the mandible (of Fig. 46).
*C.* Diagrammatic representation of the same after expansion of the dental arch, accompanied by an increase in width across the inferior border (of Fig. 47 and its legend).

width between the glenoid fossæ, for one could hardly increase the distance between the condyles without also increasing it between their containing fossæ, and this involves a widening of the temporal and sphenoid bones. I need not recapitulate the corresponding effects on the maxilla. These are the objects, in addition to normal occlusion, that have to be obtained in the treatment of a case of Class I (Angle) or Class II (Bennett).

Some orthodontists have told us that the movement of misplaced teeth develops bone, but it is difficult to reconcile this statement with Wolff's law—the amount of growth in a bone depends upon the need for it—unless those teeth were made to function so perfectly and thoroughly that bone would develop in response to the muscle activity irrespective of age, and we have not been informed that a diet requiring vigorous mastication is a part of

the treatment. From a common-sense point of view, the possibility of successfully producing the changes in the bones suggested in the previous paragraph does not appear to be what some would have us believe and may be no more than we indicated in Figs. 44-B and 46. At 12 years success would be more probable than at 18 or 20; but less probable than at 4 or 6, and it is at such early ages as the latter that these bone deformities should be corrected by exercises and appliances. Even at these tender ages it seems doubtful if the loss of growth in still earlier years can ever be entirely recovered.

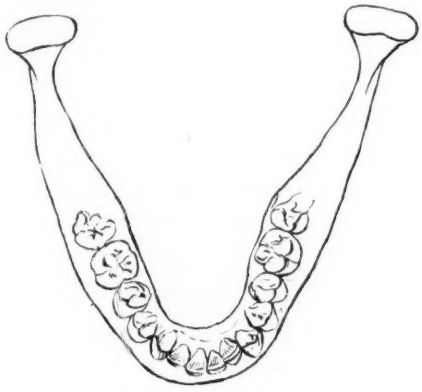

Fig. 45.

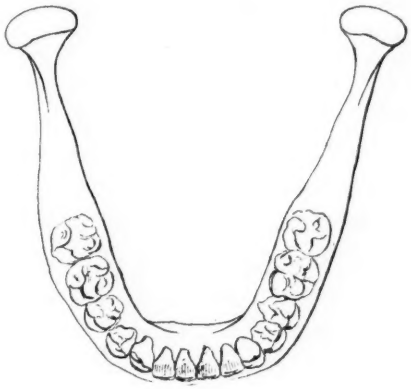

Fig. 46.

Fig. 45.—Diagrammatic representation of a mandible whose dental arch is too narrow and too short; presumably the width across the inferior border (of *A* Fig. 44) and across the condyles is too narrow, and presumably the length from the condyle to the symphysis is too short.

Fig. 46.—Diagrammatic representation of the mandible shown in Fig. 45 after expansion of the dental arch laterally and anteroposteriorly but without change in the width of the lower border or length of the mandible itself.

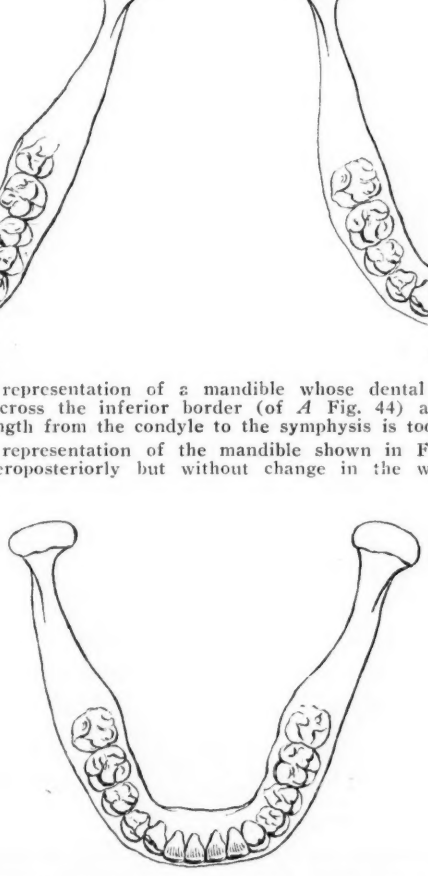

Fig. 47.—Diagrammatic representation of the mandible shown in Fig. 45 after expansion of the dental arch to the same size as shown in Fig. 46 but accompanied by an increase in width across the inferior border and condyles of the mandible and by an increase in length of the mandible. The writer believes treatment should aim at these latter changes as well as alignment of the teeth and that they can only be looked for if it is undertaken very early, say not later than six years.

Is not orthodontics but a branch of orthopædics? Do not orthopædic surgeons treat their patients at very early ages? Why should the orthodontist wait until all the permanent teeth have erupted before beginning treatment? True, the orthopædist deals with large bones and deformities that are apparent to the untrained eye much earlier than are irregular teeth, and so his facilities for early treatment are greater, but as orthodontists have we done all that is possible in the way of early treatment? The trained eye of the dentist is able to diagnose these cases at six years at the latest, and

often earlier. The younger the individual, the more plastic the tissues; therefore, the earlier the mechanical expansion of the dental arch is undertaken, the more likely is it to produce expansion of the body of the mandible, of the rami, of the condyles, etc. (Fig. 47), and with it must be combined normal functional activity of the muscles of mastication and exercises for the various muscle groups which are concerned in the masticatory process, and these exercises should not cease abruptly with the masticatory groups, but be supplemented by others for all the muscles of the head, face and neck, as well as by breathing exercises.

Jaw growth takes place irrespective of full functional activity, but unless there is full functional activity the extra few millimeters' growth that makes all the difference between regular and irregular teeth does not take place. The etiological factors need very careful consideration in each case—firstly, with regard to the class in the Angle classification, to which the case belongs, and secondly, with regard to the individual characteristics of each case. When the particular bone maldevelopment of the case has been decided on, then mechanical stimulus should be used in the form of apparatus to correct the malposition of teeth, but this should only be subsidiary to the other stimulus, full functional activity and muscle exercises to correct maldeveloped parts, to reduce excessive development in one part and to increase the underdevelopment of other parts.

There have been numerous references to dentistry recently in the newspapers, and one paragraph in the *Times* last week caught my attention. It runs: "The need is perhaps more for science than mechanics, that is, for prevention rather than cure." That is applicable to what I have been saying this morning, though those words were intended to have an entirely different meaning in their original context; but we need more of both science and mechanics for the jaws. The newspaper continues: "English parents simply must be convinced that children's food matters enormously for children's teeth. Here is a great opportunity for the dental profession. It must teach the public what to eat and how to eat, for tooth exercise is every whit as important as the exercise of muscles." The writer seems to have overlooked the fact that tooth exercise is muscle exercise.

I will conclude by reading Wolff's law: "If a normal bone is used in a new way its structure and form will change to meet its new function; if a deformed bone is rectified, and its normal function thus restored, then that bone will reassume and retain its normal shape and structure."

DISCUSSION

The *President* thought one point Mr. Chapman had touched on—the difference between the naturally and unnaturally fed child—was the basis of most of the trouble one met with. The muscular effort of a naturally fed child was much greater than with a bottle-fed baby. He was sure that nearly all the irregularities met with were due to the fact that sufficient development did not take place in the very early stages of life, almost directly after birth. The dire results of bottle-feeding should be impressed on parents. In his own practice he had noticed that in some families those children, who had been fortunate to have been naturally fed had well developed jaws and no irregularities, where-

as others, less fortunate, suffered from a decided lack of development; 90 per cent or more of the irregularities one came across were due, in his opinion, to lack of development in very early life.

*Mr. H. G. Watkin* (Liverpool) said Mr. Chapman agreed that the deciduous teeth were nearly always in normal occlusion, and said that at a later date irregularity was found in the anterior part of the mouth owing to under-development of bone. He would like to suggest that that under-development of bone, in the great majority of cases—he did not say all—was due to caries and to the early extraction of deciduous teeth. That reduced the need for bony growth, and therefore reduced the growth, as the amount of bone depended on the need for it. When the time came for the permanent teeth to erupt, the space having been lost, they erupted irregularly. If the deciduous teeth were filled instead of extracted, or, if beyond filling after extraction the spaces were maintained by suitable bands, or in some other way, he thought there would be no lack of bony growth and that permanent teeth would erupt in normal occlusion. It was most important not to extract deciduous teeth until their due time. Nature responded very quickly by laying down new bones, once the teeth had been brought into normal occlusion. He was one of those orthodontists who held that the correction of malplaced teeth brought about the development of bone, and he thought that was in accordance with Wolff's law. He quite agreed with Mr. Chapman's condemnation of those orthodontists who waited until all the permanent teeth had erupted before commencing treatment. If Mr. Broderick and others would carry their researches a little further and find the correct diet that would make the vitamines induce the ductless glands to fufill their functions normally, he thought there would be no caries and no further need for dentists.

*Mr. H. J. Morris* (Sheffield) thought the paper was a most valuable contribution to the problem of the etiology of irregularities, and the members were deeply indebted to Mr. Chapman for advancing their knowledge so considerably in that direction. He would like to emphasize what the President had said as to the great importance of the natural feeding of infants. Anyone who watched a baby being nursed by its mother would see that it had to work hard indeed for its living, practically from the day it was born; one could see it struggle and sweat in its endeavors to get properly fed. In that connection one had to consider what actually happened. The baby not only took the nipple into its mouth, but a good deal more, and in all probability that had a good deal to do with the expansion which nature designed the arch to have. Moreover, the act of sucking very powerfully caused the tongue to act as a wedge to the back part of mouth, and that had a spreading effect on the posterior part of the maxilla and brought about a widening of the nasal passages which was, he supposed, what Nature was aiming at—getting sufficient oxygen to supply good metabolism throughout the system. He would like to ask Mr. Chapman whether there could be said to be any noticeable increase of irregularities *pari passu* with the great increase in bottle feeding that was taking place at the present time. In that connection, he might mention something he had heard with regard to the state of affairs in the United States of America. In the United States there were many people who came from Northern Europe, where the climate was different—there were more clouds, and so on—and the skins of those people were less pigmented. In the United States they were subjected to powerful sunshine, which their skins were not sufficiently pigmented to withstand. The result, he was told, was that the health of the women suffered considerably, though he did not know in what particular ways. He understood, however, that in the great cities, at any rate, the natural feeding of children was not carried on even to the same extent as in this country. That was also the case in South America, but in South America the practice of employing wet nurses—by those who could afford them—was almost universal. There was also the question of the collection and transmission of milk, which became more and more difficult where the temperature was higher. In this country the collection and transmission of milk was not very difficult, but in America, he believed, it was found to be affected by the much higher temperatures under which the

people had to live. The present meeting might be characterized as one at which the important question of the etiology of irregularities had been moved a considerable step forward by the direction of attention to one great factor—the growth of bone due to the action of early and necessary muscular development in the baby.

*Mr. N. Black* (Broughty Ferry) thought that in all medicine and in all surgery—dental as well as the rest—one often found almost too late that one had been treating symptoms instead of starting earlier. The question of treatment, he thought, resolved itself into the fact that one must start at the beginning; one could not start too early. In directing their attention to the condition of the patient even at birth, they were a little late; it was necessary, in questions of irregularity and the prevention of caries, to consider antenatal conditions. The President had suggested that possibly there was much less irregularity in the temporary dentition than in the permanent, and he thought everyone would agree with that. He was of opinion, however, that all those irregularities which were so commonly met with were due to our departure from normal conditions. Up to the time of birth the child had departed much less from normal conditions than it did afterwards, and therefore one would naturally expect that there would be a much smaller departure from normal in the temporary dentition than in the permanent. In the antenatal condition a child could not live so abnormally as it did in a civilized state. It therefore seemed that a return to the normal was necessary for the correction of irregularities. Mr. Broderick had shown that the endocrines were at fault in a departure from the normal in caries, and personally he believed that was the case with irregularities also. While one might artificially supply and substitute the secretions of the ductless glands to make up the deficiency, it was really a question of getting back to Nature. Nature would supply endocrines that would function properly and that would give a proper amount of calcium for the making of bones and teeth and for keeping teeth of reasonable size in jaws of a reasonable size. If children were brought up under normal conditions in the future, they would not require artificial help. Orthodontists were at present treating symptoms when they should be advisory and getting back to causes. The old Chinese system of paying the physician when the patient was well had much to recommend it. If orthodontists occupied advisory positions instead of being curative surgeons, they would still have plenty of work to do. He knew that all he was saying was theory, and compared in that respect unfavorably with the very practical paper which Mr. Chapman had given, but he thought it was useful to collate all the information obtained from the various papers, and by so doing it would be seen that until practitioners treated their patients from the very beginning and advised them from the start they would continue to treat symptoms instead of eradicating causes.

*Mr. R. B. Hunter* (Scarborough) said that his experience had not led him to agree with all that the President and Mr. Morris had said. Some years ago he had examined very carefully about 500 school children at one of the elementary schools at Scarborough, and had then gone round to the mothers and asked them how they had fed their children. The results, from a theoretical point of view, were very disappointing. About half the children had been bottle-fed and half breast-fed. To take two typical cases—in one instance, two boys of magnificent physique and with perfectly regular teeth had been fed on Nestlé's milk, while in another, a miserably-developed child, rickety and with very carious teeth, had been fed naturally. He thought it was necessary to start at the very beginning—to start with the mother, and while he knew the American view was that irregularities were not inherited, from his own experience he thought that view was incorrect; he had come across many cases of one particular irregularity going down over three or four generations. He had acted as a part-time school dentist for 6½ years, but one distressing feature of the work was that about 75 per cent of the children suffered from Angle's Class I, and a smaller percentage from other classes, and yet one could do nothing for them.

*Colonel C. H. Howkins* said he had heard the view expressed that dentists were getting very highly specialized, and perhaps did not take a wide enough view of the various matters which came within their province. It had occurred to him that there was only one other case

in the body, as far as he knew, where a slight maldevelopment of bone gave rise to such serious trouble, namely, in connection with the female pelvis. There was a certain amount of similarity between the two cases. There were three malformations of the female pelvis. One was a small round pelvis, normal in shape but deficient in size. The second was known as the flattened pelvis; it was contracted antero-posteriorly. The third one was more or less the old saddle-shaped arch, which was taught a quarter of a century ago. It was due to a disease known as austro-manacea, which arose from there being a deficiency in lime salts in the bone, so that the pressure of the muscles forced the hips in, the bone being unable to withstand muscular pressure. The small round pelvis was ascribed either to under-development in childhood or to its possessor having lived a lazy life. With a small arch, provided the teeth were small, there was no trouble, and the same was true of a small pelvis—if the child was small too, it was all right. It would be seen that there was some similarity between the two. There might be, and he believed there was some great underlying principle which caused all those deformities. He was inclined to believe in the correlation of growth. It was well known that a cleft palate was often accompanied by a club foot, and in orthodontics irregularities would probably be found to be connected with other slight abnormalities in the body. It was a very large subject, and required considerable knowledge of pathology if it was to be worked out, but he thought it would lead to something definite. It was important to get at the root of the causes of these things rather than treat them after they had happened.

*Mr. C. E. Thomas* (Ashford) said that in India and Africa the effect of food on the muscular development of the jaws of the natives had been very noticeable. The staple food of the Indians was ala, made from native flour, which not only required more mastication but which contained many more vitamines than our own bread. The African's food consisted of fruits and natural foods such as roots, and it went without saying that people in the bush fed their babies naturally. The jaws of Africans were very well developed, even more so than Indians, and that he attributed to the food which they ate. With civilized peoples the heads tended to be over-developed and the jaws under-developed.

*Mr. C. H. Housden* (Guildford) said that medicine and surgery were divided up into various branches, and suggested that as dentistry covered a very wide area there might also be branches in dental surgery. There should be schools to which dentists might go after having qualified and study orthodontics, diseases of the gums, and so on, and carry out further work on pyorrhea alveolaris and peridental diseases, and thus fit themselves for dealing with cases which required specialist treatment.

*Mr. C. Rippon* (Dewsbury) said it had been demonstrated beyond a shadow of doubt by Professor Fawcett the previous day, and by Mr. Chapman that morning, that the functioning of the muscles stimulated the growth of bone. It was a very poor rule that did not work both ways, and the bone disappeared directly the function of the muscles was removed. He examined a short time ago the skull of an old lady who had never worn artificial teeth, but who had had only two natural teeth—the lower canine on the left side and the second bicuspid in the upper jaw. Her mouth had evidently been devoid of teeth, other than those two, for a considerable time. In masticating on those particular points the condyles on the opposite jaw had entirely disappeared, and the glenoid cavity had entirely gone, showing that if the function of the muscles was removed the bone disappeared altogether. It would be interseting if Mr. Chapman could give the reason for that.

*Mr. G. F. Cale-Matthews* (Birmingham) thought that one or two exaggerated statements had been made in the discussion. One was that irregularities were not so common in the temporary dentition as in the permanent. He ventured to suggest that they were very much more common in the temporary dentition than was generally realized. Anyone who had the opportunity of examining deciduous teeth would be surprised at the number of malformations, particularly in the relations of the mandible and the maxilla, which they would find. With regard to natural feeding, the responsibility for the neglect of that did not lie with the dentist or with the mother, but with the medical profession. The medical profession was only too ready to acquiesce in the desire of an indolent mother to secure relief

from trouble. As a consequence of the growth of patent foods of all descriptions and the methods adopted to advertise them, apparently well-developed, fleshy children were being produced instead of lean, hard, bony ones. His own three children—two boys and a girl—were all breast-fed and of enormous physical development—the younger boy at 14 years of age was 6 ft. 1 in. in height—but they all had narrow jaws anteriorly and Class II, because their mother was Class II. Heredity played a large and important part in the matter, and must not be lost sight of; every care should be taken when making a diagnosis to take into account hereditary factors.

*Mr. G. G. Campion* congratulated Mr. Chapman on his courage in tackling a subject about which very little was known. Mr. Chapman had reminded the members, not only of Wolff's law but of the law of Del Pacies, that the shape which our limbs and the different parts of our body took was the result of balance and opposing groups of muscles. If one investigated the way in which that law applied to the mouth and teeth one came very nearly to the proposition which Dr. Sim Wallace expounded about fifteen years ago, that the shape of the arch was largely the result of the interaction of the muscles outside and the muscles inside, the facial and masticatory muscles on the one hand, and the muscles of the tongue on the other. Some of the irregularities which were met with were undoubtedly due to the abnormal functioning of those two muscular groups. There had been an ample discussion, and Mr. Chapman had received the thanks which all the members would agree were his due, but it must not be forgotten of course, that the subject was far too intricate to be solved by any application of those muscular laws. The physiology of growth was a subject of immense intricacy, and all those complexities had to be considered when dealing with the matter, as well as the muscular abnormalities. One was also "up against" the relation which the process bore to the philogenetic history, and the question of the influence of heredity, as disclosed by Mendel's law. There were so many difficulties that he confessed that even after hearing the paper he knew nothing about the subject; he would content himself with looking forward to hearing the matter thoroughly expounded in, say, twenty-five years time.

*Mr. W. H. Dolamore,* in a written contribution to the discussion, thanked the author for his valuable contribution to the knowledge of the etiology of malformed dental arches. Though he was in agreement with the general argument set forth in the paper; it did not appear to him to cover the whole ground. The main contention appeared to be that, given normal use of the jaws and air passages, with the consequent normal development of muscles and air sinuses, there would always follow normal development of the maxilla and mandible and, as an inevitable sequence, normal dental arches. There seemed to be other factors concerned, but those had been passsd over in silence. Without attempting to enumerate the whole, the following had occurred to him:—

(1) Inherited tendency. As an example it was only necessary to take the case of the Hapsburg family. Whatever was the active cause of their deformity, there was present an inherent ability of the jaws to grow abnormally, which no normal use would appear likely to check.

(2) The teeth were not, in very many cases, developed in a normal position and deflected during eruption, but the reverse. They were often developed in a more or less abnormal position, and that was normally corrected during eruption. If it was not so corrected the tooth erupted abnormally, and the abnormal position it assumed might cause the misplacement of other teeth. If the alveolus and other portions of the jaws were regarded as one, then, if it was admitted that the alveolar bone developed around the root of the tooth or teeth in abnormal positions, there arose not only considerable misplacement of the dental arch, but malformation of the maxilla or mandible, both independent of function.

(3) The author appeared to take too limited a view of the physiological activity of the muscles concerned. The difference of diet and of the use of the jaw muscles for their normal purpose would appear insufficient to account for the almost excessive mandibular development in the extremely muscular. It would seem nearer the truth to say that any vigorous bodily exercise was accompanied by vigorous contraction of the jaw muscles, or in other

words by vigorous clinching of the jaws, which might in their combined duration and effect exceed those specially applied to the chewing of food. If that was true it would be more logical to advocate the gymnasium rather than jaw exercises *per se.*

(4) A cursory examination of the deciduous and permanent teeth led him some years ago to think there was no constant relationship in size between them. If that was so, clearly, to obtain space for the latter, there must in some cases be comparatively excessive development of bone; that development appeared doubtful, the more so because there did not appear to be a constant relationship between the size of the jaws, which might compare favorably with other skeletal development, and the size of the teeth. If that was true there was another factor, quite independent of muscular development.

He had called attention to the variation in the development of the eminentia articularis. The form of the articular surfaces of the temporomandibular articulation was not constant. It might be worth while to investigate the variations of the different articular surfaces and to see if those were or were not associated with those of the dental arches, especially the occlusal plane. If expansion of the lower dental arch really caused expansion of the whole mandible it should be easily proved. Similarly, one awaited actual demonstration of the hypothesis that expansion of the upper arch caused expansion of the nasal cavity.

*Mr. Harold Chapman,* in reply, said Mr. Watkin had referred to irregularities due to caries and the early extraction of deciduous teeth, but in his paper he had endeavored to confine himself entirely to Bennett's Class I and Class II, and not to complicate the subject by introducing irregularities due to local causes. He had had no opportunity of seeing statistics with regard to an increase in the number of irregularities as a result of bottle-feeding, nor could he say anything with regard to the effect of climate. He thought Mr. Campion's remark about hearing more of the subject in twenty-five years time was very apt, because Wolff's law was first formulated forty-five years ago, and thirty years had elapsed since it was enunciated in the form in which he had read it in his paper. With regard to Mr. Rippon's remarks, Dr. Fawcett had said that there was a loss of bone as a result of the muscles being insufficiently used when all the teeth were lost. He feared he had not made himself clear on the question of the temporary dentition, because he agreed with all those speakers who said that the trouble did begin then, or even earlier, though it was not so easy to see. With regard to Mr. Cale-Matthews saying that his children were Class II because their mother was Class II, there were other similar cases where it might be held that the children were like their parents in that respect because they had been brought up under the same conditions and in the same environment. He thought that explanation would find as many adherents as the one Mr. Cale-Matthews had given.

The President said no better compliment could have been paid to Mr. Chapman than the discussion which had taken place on his paper, which showed the interest the members took in it. It was hardly necessary to propose a vote of thanks to the author for his excellent paper, because the members had already shown their appreciation by the interest they had taken in the discussion.

The vote of thanks was carried by acclamation.

The meeting then adjourned.

# *DEPARTMENT OF ORTHODONTIC TECHNIC*

**Edited By**
**H. C. Pollock, D.D.S., St. Louis, Mo.**

## ELEMENTARY ORTHODONTIC TECHNIC

### Intensive Orthodontic Technic—Separating the Teeth Preparatory to Fitting of Bands, Particularly Molar Bands

By H. C. Pollock, D.D.S., St. Louis, Mo.

SEPARATING ligatures of soft, annealed No. 24 gauge orthodontic wire (Angle's or Luken's) should be twisted tightly about the contact points, mesial and distal to the anchor teeth about to be banded. The ligature should be inserted and twisted tightly about the contact points, the free end then cut off, leaving only about one-eighth of an inch. The free twisted end is then pushed toward the gingiva in order that it may not interfere with mastication or act as an irritant to the cheek. Ligatures should be twisted tightly with a pair of pliers (Howe No. 110, or similar to the same in design). The free end must be tucked carefully between the teeth in such a manner that it will not subsequently work loose and become displaced.

The separating ligatures should be allowed to remain in this position not less than twenty-four hours, after which time they should be removed. Ample space is thus provided at the contact points for the easy insertion of the band or band material between the approximating teeth. (See Fig. 1.) In the event sufficient space has not developed between the teeth during the interval of visits of the patient, the ligature may be removed and a new one inserted and again twisted tightly to provide more space. It is imprudent to try to fit molar bands on the teeth of children until ample space has been provided for the easy insertion of band material between the teeth.

#### FITTING OF ANCHOR BANDS—CLAMP BANDS

After approximal contact points on the teeth have been separated sufficiently to allow free passage of the band material, a very careful technic has been described in dental literature in the past for the proper fitting of clamp bands of the screw type on to molar or anchor teeth. Clamp bands must be fitted carefully to prevent inflammation of tissue which may arise if the screw projections are not adapted well and carefully to place. No small amount of care must be exercised to keep the screw posts from projecting toward the tongue. The screw shaft should be adapted well up in contact with the lingual surface of the premolar teeth. (Fig. 2.) (See Dewey: *Practical Orthodontia,* Clamp Bands, Advantages of Different Types, ed. 4, p. 178.*

*For further detail see Angle, Edward H.: Orthodontia and the Ribbon Arch Mechanism and Some Small New Auxiliary Instruments, Dental Cosmos, lxii, Nos. 10 and 11.

There is another type of patented molar clamp band with the clamping device located upon the buccal side which is practically valueless inasmuch as the buccal tube which engages the labial arch wire cannot be shifted in its relative position in order to establish harmony of adjustment between the labial arch wire and buccal tube which engages it. To be more explicit, it is quite rare indeed that the above type of molar band may be fitted to the tooth, and the arch wire later adjusted to fit it with any degree of accuracy and harmony of position. If patented clamp bands are used for molar attachment, they should be the type with the screw post and nut located on the lingual side of the tooth to be banded, with a buccal tube on the buccal side which may

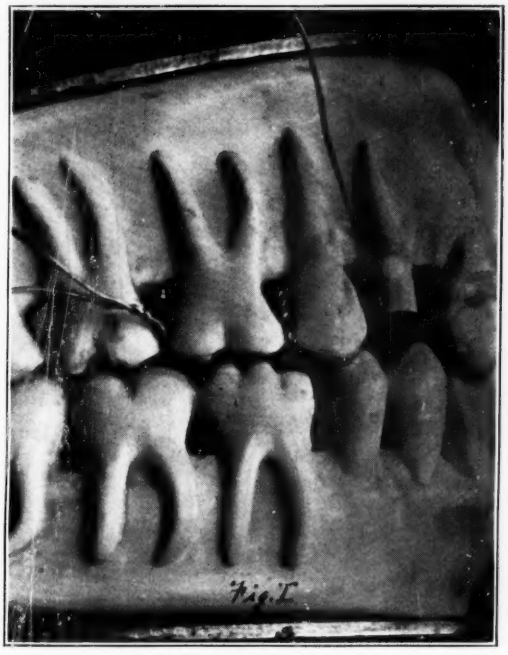

Fig. 1.

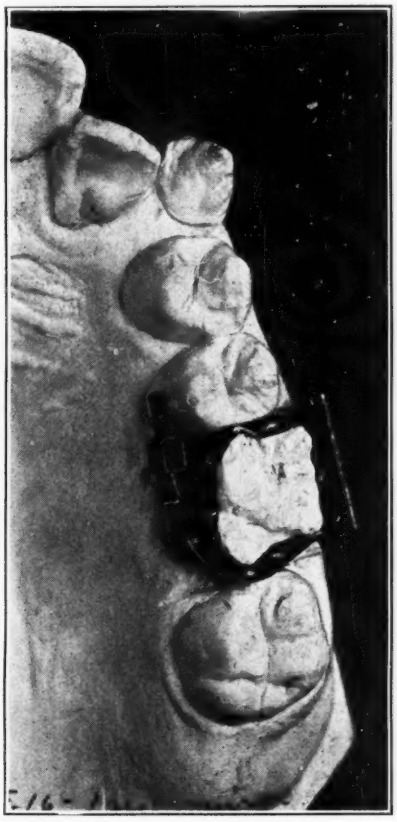

Fig. 2.

be shifted in its position at the will of the operator by heating and flowing the solder thereon.

There has been no small amount of controversy in the past regarding the relative merits of the so-called patented clamp band and the plain soldered band. The test of time, however, has amply demonstrated that the plain soldered molar band is much more popular and more extensively used among orthodontists than are the clamp bands. Notwithstanding the merits claimed for clamp bands, plain bands properly constructed will qualify equally as well and have many advantages, one of which is that the plain band may be made of any one of many materials desired by the operator, while the clamp band must be used made of the material decided upon by the manufacturer.

*(To be continued.)*

# *DEPARTMENT OF*
# *ORAL SURGERY AND SURGICAL ORTHODONTIA*

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## MALPOSED TEETH: THEIR CLASSIFICATION, PATHOLOGY AND TREATMENT*

By Theodor Blum, D.D.S., M.D. (Penn.), Universae Medicinae Doctor (Vienna)

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ANY tooth which is not in its normal position should be called malposed. Slight malpositions (irregularities) of erupted teeth belong to the field of the orthodontist, malposed unerupted teeth to both the orthodontist and oral surgeon, if their malposition is to be corrected.

Deciduous, permanent, and supernumerary teeth (including those seen with odontomas, follicular and multilocular cysts) have been found in pathologic positions. They may all be partly or fully developed and also unerupted, partly erupted and erupted. Unerupted and partly erupted teeth may be covered by soft tissues or bone, or by both. However, according to the age of the patient, a certain state of development and eruption can be normal. The most important subdivision of malposition is the impaction.* Impaction means the abnormal contact of one tooth with another, which, as a rule, is in normal position, although two or more teeth may be embedded against each other. The presence of pressure cannot very well be demonstrated in every case. The maxillary and mandibular third molars show those abnormal positions most frequently and can be subdivided in slight, semihorizontal and horizontal impaction. A tooth partly or fully covered by soft tissues or bone, or both, must not necessarily be impacted. A malposed tooth may lie in no

*Read before the Meeting of The Ninth District Dental Society, December 9, 1922.

*Impact, n.
1. An impinging; a sticking together; collision; forcible contact; force communicated.
2. Specif.; mechanical act of impinging, as of one body against another.....
Impaction, n.: Act of becoming, or state of being, impacted.....
Impacted, p. a.: Driven together or close; firmly fixed.....
Impact, v. t.: To drive close; to press firmly together; to fix firmly; to pack, to wedge.....
Webster's New International Dictionary of the English Language, 1918.

direct relation with any other tooth; they must then be described as lying in the ascending ramus, at the lower border of the mandible, in the hard palate of the maxilla, etc.

Malposed teeth should be either placed into their normal position or removed. The reasons for this statement are given below:

Infection (acute, subacute and chronic) occurs very frequently between

Fig. 1.—Malposed and partly erupted left maxillary second deciduous molar. (Female, age 13.)

Fig. 2.—Malposed and partly erupted (buccally) left maxillary second deciduous molar. (Female, age 14.)

the tissue flap covering a partly erupted malposed tooth, resulting at times in a pericementitis or periostitis, but not infrequently developing into osteomyelitis and submaxillary and cervical lymphadenitis or both. Trismus is always present if the infection invades the tissues in the vicinity of or the muscles of mastication themselves. Peritonsillar and pharyngeal abscesses have been regarded as caused by such infections. A similar pocket also de-

velops in the angle formed by the partly erupted malposed teeth and the adjoining one, eventually causing the loss of both the malposed and the normal tooth. Even if no pus is present, the fact that these spaces are very difficult to be kept clean, decay easily develops, affecting one of the two teeth or both. That an impaction frequently causes absorption has been proved by the absorption of enamel, cementum and dentine even to the extent of expos-

Fig. 3.—Malposed and partly erupted right mandibular second deciduous molar causing malposition and deformity of second premolar. (Female, age 18.)

Fig. 4.—Follicular cyst originating from malposed and unerupted right mandibular canine, the crown of which could be felt by external palpation. (Female, age 26.)

ing the pulp canal and chamber. The orthodontist frequently notices after the completion of a case, that the mandibular anterior teeth become crowded again when after radiographic examination usually an impacted third molar is detected. The removal of the offending member, other conditions being normal, prevents reoccurrence. One of the most important, if not *the* most important reason for the early removal of malposed teeth, is the possibility

of their causing nervous reflexes. Under diagnosis, such cases will be cited. The formation of follicular cysts from deciduous, permanent and supernumerary teeth can be prevented if adhering to the rule established at the beginning of this chapter. It is not only a question of losing the tooth around

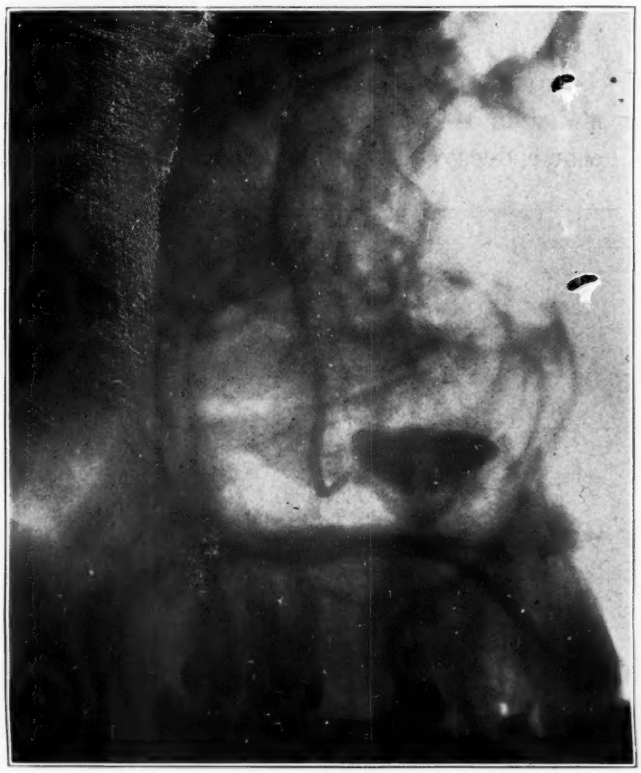

Fig. 5.—Malposed and unerupted right maxillary canine situated in the anterior and lower corner of the wall which separates the nasal chamber from the antrum. (Female, age 21.)

Fig. 6.—Follicular cyst in region of maxillary incisors originating from malposed supernumerary tooth. (Male, age 32.)

the crown of which the cyst is forming, but also the loss of many normal teeth if such a cyst is left undisturbed and assumes large dimensions. There is a possibility, although slight, of partly erupted malposed teeth developing into a focus of infection. An unerupted tooth, whether malposed or not, was never

found to be infected, the only possibility being that the vitality of the soft tissues covering an unerupted tooth is lowered by the continuous irritation of an opposing tooth, for instance, biting on it, the soft tissues becoming infected and carrying such infection to the follicle of the tooth. The author has never seen or heard of such a case. Many teeth, however, appear unerupted but are not entirely so. Very often a probe can be passed between the gum tissue and the distal neck of a second molar reaching an apparently unerupted third molar in this manner. Under these circumstances, such a tooth may also become decayed. Simple and composite odontomas must be

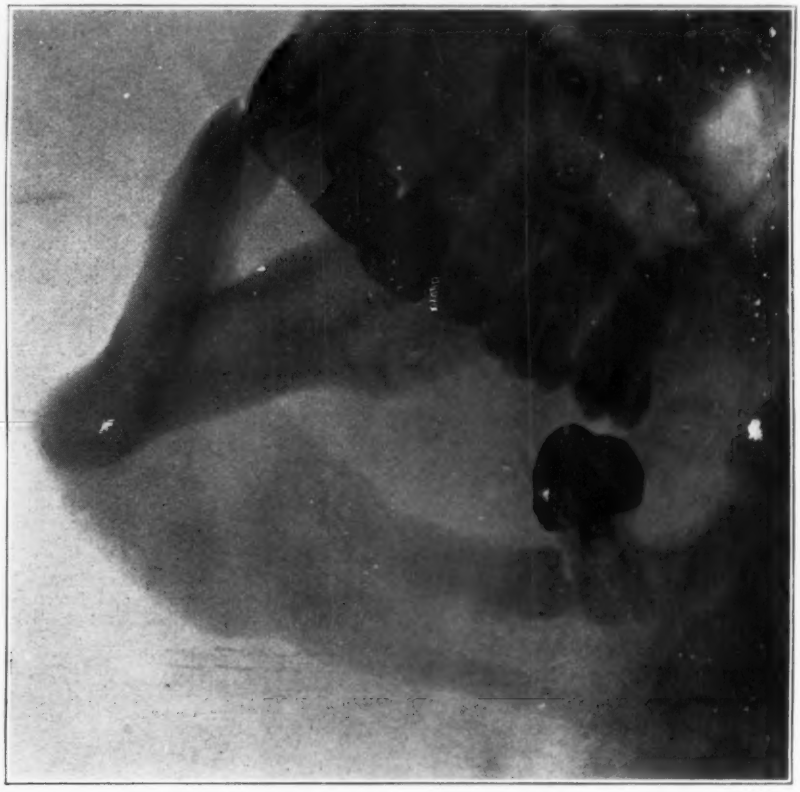

Fig. 7.—Malposed and unerupted left mandibular premolar in horizontal impaction against molar. (Male, age 30.)

mentioned here on account of the fact that they often retard the eruption of permanent teeth.

In summing up, one must come to the conclusion that malposed teeth, if they cannot be placed into their normal positions, should not only be removed, but removed as early as possible, so as to avoid the appearance of the above-mentioned conditions, and because the operation in the young patient is easier for the patient as well as the operator, the bone being less calcified and the roots only partly developed. The oral surgeon is well familiar with the difficulty arising from curved roots of the third molars as well as maxillary canines.

The diagnosis of malpositions of teeth is, as a rule, not difficult. The

radiographic examination is a great aid, the exact position being best determined by two radiograms at right angles.

Stereoscopic examination has the disadvantage that many operators cannot look through a stereoscope and because the relative position is more mathematically figured out by right angle pictures. If a member of the dental arch is missing, if a swelling on the palate or any other part of the jaws is found, or if one or more teeth become loose, a careful study of the case, including radiographic examination, is indicated, and when a malposed tooth is found, more serious conditions are excluded.

A young girl, age sixteen, undergoing orthodontic treatment, showed upon radiographic examination, two unerupted and partly developed malposed mandibular third molars in semihorizontal impaction. Although there

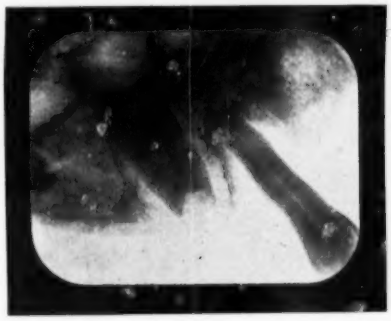

Fig. 8.—Malposed and partly erupted left maxillary second premolar crown pointing upward. Slight cyst formation. (Male, age 64.)

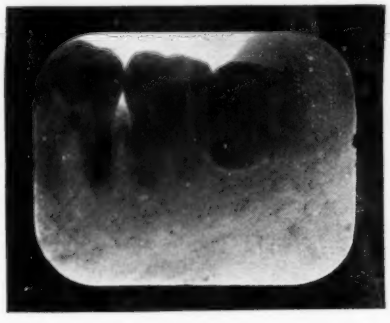

Fig. 9.—Malposed and slightly erupted right mandibular third molar impacted against second molar. (Female, age 25.)

Fig. 10.—Photograph of second and third molars of Fig. 9 placed into relative position after their removal.

Fig. 11.—Second molar of Fig. 9 showing absorption of cementum and dentine which had exposed the pulp canal.

were no symptoms, the early removal of the two teeth was advised because, by waiting, the bone would become more dense and the roots fully developed, increasing without any doubt, the difficulty of the operation.

The radiograms of another case, that of a girl of fifteen, revealed two unerupted and partly developed mandibular third molars, in other words, a normal state of development. Because of her age, removal would have been contraindicated had it not been for severe and neuralgic symptoms in the right mandible (of one and one-half years' duration), which ceased after its removal. The left third molar was allowed to remain undisturbed.

A patient about twenty-five years of age had a malposed left maxillary canine in palatal position removed in April, 1920. On December 22, 1920, I

received a letter from Dr. B., her husband, the following paragraph of which is quite characteristic:

"It might be of interest to you to know that Mrs. B. has had trouble in sleeping for the past ten years, gradually getting worse each year. Since you removed the impacted canine, she has slept good every night and as she expresses it, 'I feel better than I have in ten years and more like I used to feel.' If she had another impacted tooth and its removal had the same effect, I don't think she would ever wake up, only perhaps for meals."

Regarding the diagnosis of follicular cysts and odontomas, the reader must be referred to works on this subject. However, it can be said now, that the radiographic examination is indispensable as a routine measure.

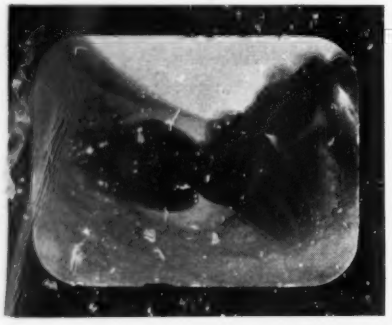

Fig. 12.

Fig. 13.

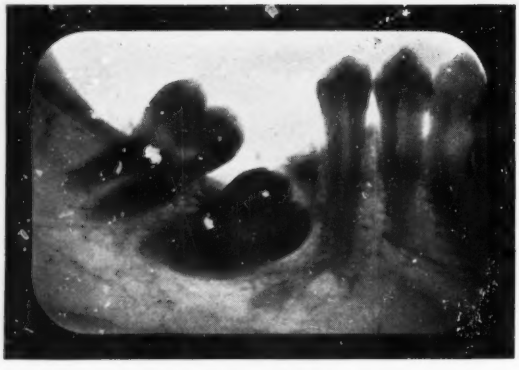

Fig. 14.

Figs. 12 and 13.—Malposed and partly erupted right and left mandibular second and third molars impacted against each other. History of acutely infected pocket on the left side followed three months later by one on the right. Only the third molars were removed, the second molars to be placed into position by orthodontic treatment. (Female, age 16.)

Fig. 14.—Anterior root of left mandibular first molar; malposed and unerupted second molar apparently impacted against the root of the first molar; malposed and erupted third molar. The operation consisted of the removal of the root and the second molar, the position of the third molar to be corrected. (Male, age 25.)

In considering the treatment of malposed teeth, the principle outlined before must again be repeated, namely, that malposed teeth should be either placed into normal position or removed. The orthodontist should always be consulted when the question of correcting the position of a malposed tooth is under consideration. In fact, it is best to have this specialist present at such an operation.

The anesthesia of choice in the vast majority of operations for correc-

tion, as well as removal of malposed teeth, is block anesthesia. Very rarely indeed will a general anesthetic be employed and if so, its employment is subject to conditions and circumstances which govern the selection of an anesthetic in any other operation.

The conservative operation of correcting the position of a malposed tooth is most frequently used for the maxillary canine, less often for the mandibular. When first performing the operation of exposing a maxillary canine in palatal position, a sufficient portion of the soft tissues overlying the crown of the tooth was cut out and then the bone chiselled away around the crown of the tooth to enable the orthodontist to cement a hook into the crown by which the malposed member then could be pulled into position. Later on, the same flap was made for the exposure of these teeth as in the operation of their removal, namely, an incision approximately ¼ cm. away

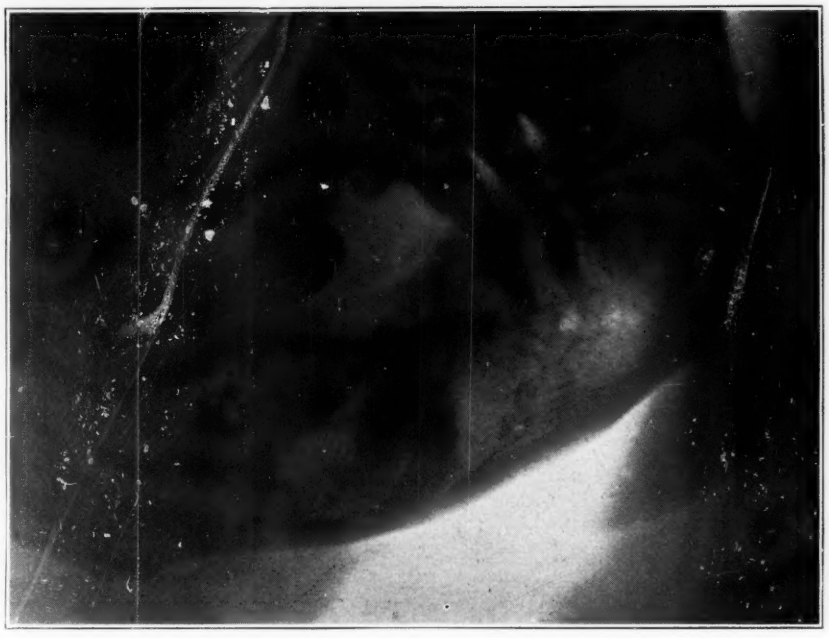

Fig. 15.—Malposed and unerupted right mandibular first and second molars, the second impacted against the first; malposed and erupted third molar. On the alveolar ridge between the third molar and the second premolar there was a fistulous opening discharging pus-like material. When this tract was explored, the probe came in contact with hard tissue which felt like enamel. The three molars were removed. (Male, age 45.)

from the palatal gingival edge at the lateral incisor of the opposite side and across the median line to the region of the interproximal space between the second premolar and the first molar. From the anterior point of this incision another one was carried back towards the median line of the hard palate to a point corresponding to the posterior edge of the first incision. The mucoperiosteal flap so outlined was then elevated, exposing a large surface of bone. In discussing the merits of the two incisions, one surely must admit the inconvenience of the removal of a small portion of the mucoperiosteum from over the crown of a tooth, because very often the bone surface so outlined will prove to be too small, so that more of the soft tissue will have to be removed with additional bleeding and delay in completing the opera-

tion. For that reason one should always figure on a flap which will permit a bony surface of about ½ cm. in width to remain surrounding the area where bone was chiselled away to expose the crown of the tooth. This outer area of bone affords a resting place for the flap which, when replaced, will very readily unite with it and the surrounding soft tissues. Naturally, on the palatal side of the anterior teeth, very little bone will be left. However, in case of an operation for exposure, a portion of the flap at this point is removed, anyhow, after the crown has been sufficiently exposed by chiselling away the underlying bone, so that there will be no mucoperiosteal tissue there to be supported by the underlying bone.

When a malposed canine must be removed, it is well to begin the incision at the palatal side of the lateral incisor and continue the same backward

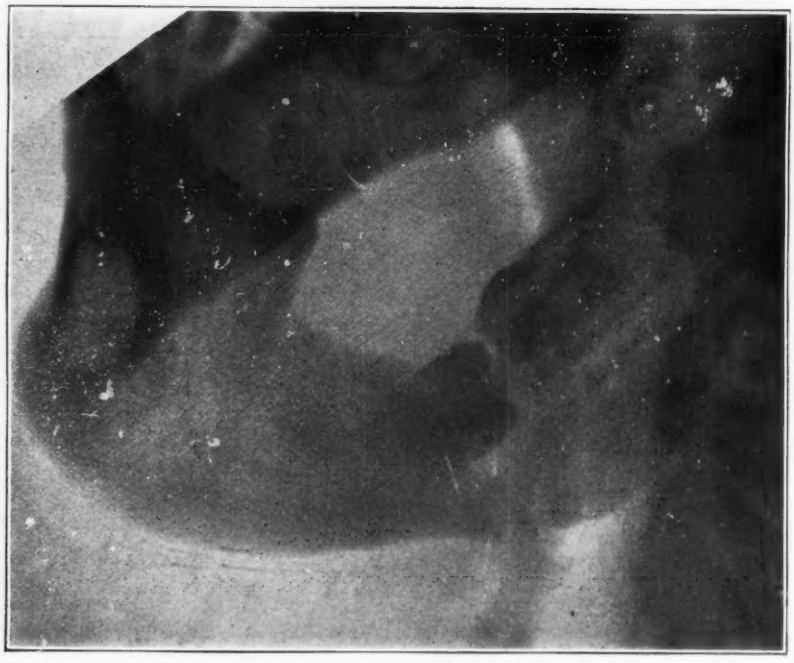

Fig. 16.—Malposed and unerupted left mandibular second and third molars impacted against each other. Mandibular fracture due to blow on the affected side; line of fracture running between the occlusal surfaces of the two molars. (Male, age 48.)

towards the median line corresponding, as a rule, at the median line to a point lying on a line drawn between the interproximal spaces of the second premolar and the first molar. About six months ago, a suggestion by Dr. Richard H. Norton of Boston was adopted and ever since practiced, namely, of separating the gingival edge from its pericemental attachment of the lateral (where the first incision was started) and then the centrals and back to the interproximal space mentioned before. At the incisive foramen, the nerves and blood vessels will have to be severed to permit the flap to be fully raised. With a little practice, this procedure will be found to be advantageous in many respects, namely, by giving more space as well as a clearer view and better healing after the flap has been replaced. No ill effects have been noticed. Such a large flap permits one to expose the crown and espe-

cially the tip of the cusp very readily from the opposite side. The simultaneous use of two elevators is too well known to be mentioned here again. After the tooth has been removed the area is well cleaned of pieces of bone and debris which may have accumulated during the operation. The flap is replaced without sutures and kept in position for ten or fifteen minutes by a piece of plain gauze placed over the wound and held in position by the

Fig. 17.

Fig. 18.

Fig. 19.

Figs. 17, 18, and 19.—Chronic periostitis of right mandible; chronic submaxillary lymphadenitis discharging pus; marked trismus. All three conditions of about one year's duration and caused by a malposed and partly erupted right mandibular third molar in horizontal position, the crown of which was decayed. No discharge intraorally. Uneventful recovery after removal of third molar. (Male, age 65.)

tongue. The patient is then seen at regular intervals and permanently discharged two weeks after the operation. At times, enough blood will accumulate to cause a marked bulging of the flap. This, however, will be absorbed in due time and only in extreme cases will the flap have to be opened. Fortunately, it seldom happens that the blood clot breaks down. Severe pain

is usually the indication. The wound is then opened at a convenient point along the incision and the bloodclot cleaned out with small cotton swabs and argyrol applied in the same way. After a few treatments the parts ordinarily heal.

If during the above described operation a tooth or teeth in the field of operation are so badly exposed that their retention is doubtful, it is better to extract them at once. If two malposed canines are to be removed at the same time, one continuous flap is raised by separating the gingival edge from its pericemental attachment from molar to molar, severing the vessels at the

Fig. 20.—Radiograph of Fig. 17.

incisive foramen and raising the flap to an imaginary line drawn between the two molars. If the crown is well exposed and still the tooth cannot be removed, one must think of the possibility of a curved root which may not have been clearly revealed by the radiograms or which may have been overlooked. Should a root break while attempting its removal, enough bone at the point of fracture will have to be removed to admit an instrument suitable for dislodging it. At times an apex is pushed into the antrum; such a root may be removed by enlarging the antrum opening or by washing the same, if small, through the ostium maxillare into the nasal fossa and out

through the nose. As a last resort, the canine fossa will have to be opened. After the removal of such a root or if at any time during the operation the antrum has been opened, no further treatment of the same is indicated unless the antrum is diseased. Should there be a question as to whether fragments of bone or soft tissues have been pushed into the antrum, then it must be irrigated before the wound is closed. Draining a healthy antrum is surely contraindicated.

The operation for the exposure or removal of malposed canines in labial position does not have to be specially described. Usually a semilunar incision has to be made, although at times an anterior incision is made, running from the gingival edge about 1 cm. in front of the approximate position of the malposed tooth, upward, when in the maxilla and downward when in the mandible, and slightly forward, and then as in the palatal operation, the gingival edge is severed from its pericemental attachment far enough posteriorly to permit complete exposure of the field of operation.

The typical removal of an impacted mandibular third molar can be

Fig. 21.—Malposed and erupted left maxillary third molar in buccal position to the second molar. (Female, age 17.)

described as follows: An incision is made from the posterior surface of the second molar along the alveolar ridge for about 2 cm. or more if necessary, followed by a second one beginning at the anterior extremity of the first downward and somewhat forward to the lower fold. The mucoperiosteal flap is then raised and retracted. The bone to be removed is outlined by small holes drilled with the electric engine through the bone on the buccal surface. After its removal the tooth will be, in some cases, sufficiently exposed to permit one to elevate it out of its socket. If not, the chisel and mallet will have to be employed to expose it further. Before suturing the flap into position all debris must be removed and the bony surfaces smoothed. An iodoform gauze drain is placed in the anterior part of the wound just posterior to the second molar and changed as often as necessary. Sutures are removed between the fifth and seventh day after their insertion. Twenty-five per cent argyrol is always applied to clean the wound and surrounding tissues. Should the blood clot break down, the same is removed in the fashion outlined previously.

The incision for maxillary third molars is started at the fold above the

second molar and carried down to the alveolar ridge at the posterior surface of the same tooth avoiding the gingiva, and then backward, running diagonally across the space distal to the second molar ending at the ridge. This flap is raised and retracted and enough of the bone overlying the crown

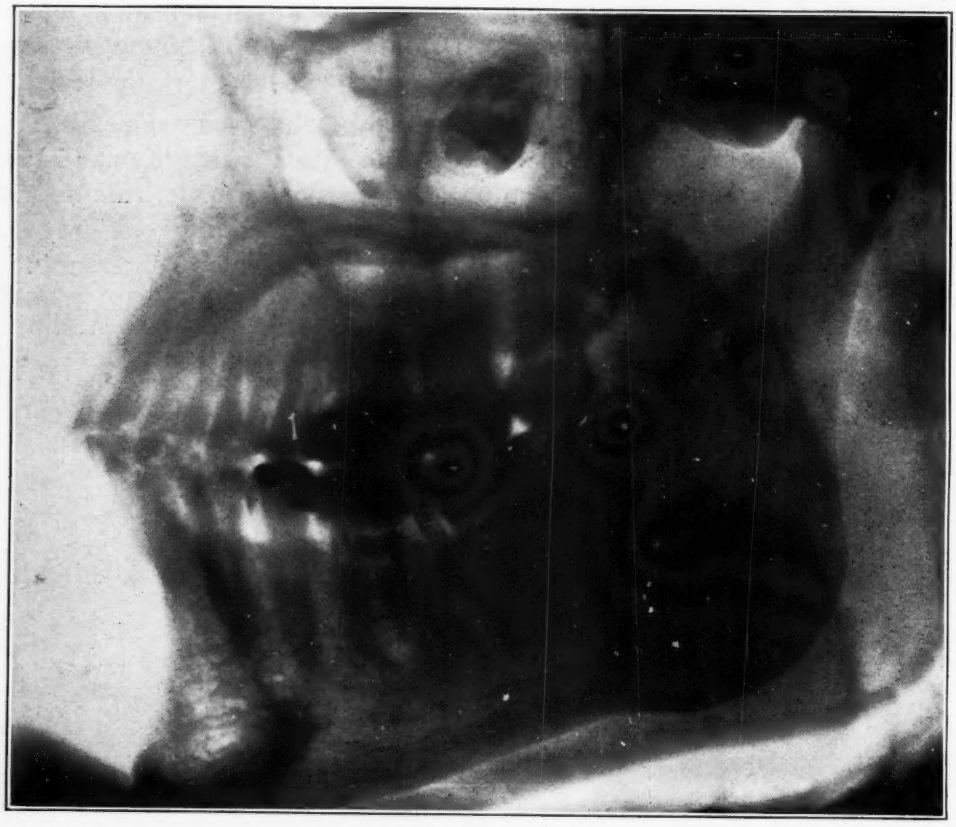

Fig. 22.—Malposed and unerupted left maxillary third molar. Its position was posterior to the antrum and just below the orbit where it had formed a follicular cyst. There was a discharging fistula on the buccal side, just posterior to the second molar. (Male, age 25.)

Fig. 23.—Malposition of unerupted left maxillary central incisor caused by composite odontoma at its crown. (Female, age 28.)

of the third molar chiseled away so as to permit its removal either by elevator or forceps. After cleaning the wound of debris, the flap is replaced, but not sutured. Usually no further treatment is necessary.

It may be well to mention here a condition which most frequently occurs around a partly erupted third molar but may occur around any tooth, maxillary or mandibular. When found around the third molar, it is usually called an infected wisdom tooth pocket. It is an infection of the gum flap covering a partly erupted tooth. Simple and permanent treatment consists in the removal of the tooth if circumstances permit. However, as long as these teeth are very often not only in normal position, but also useful, conservative treatment is indicated, during which an incision of the flap should be avoided if possible. The pocket should be carefully cleansed, applying either tincture of iodine or 25 per cent argyrol (preferably the latter), and

Fig. 24.—Malposition of unerupted left maxillary canine caused by composite odontoma at its crown. Fracture of mandible at angle. (Male, age 23.)

placing a small piece of iodoform gauze into the pocket to permit free drainage. Such dressings are changed daily. At times, the maxillary third molar is biting on the gum flap which partly covers the mandibular third molar and if the infection is very acute, removal of the maxillary one is indicated, especially if it is not an important tooth. Such an infection may travel to the peridental membrane of the affected tooth causing pericementitis, to the periosteum causing periostitis and to the submaxillary lymph glands causing lymphadenitis. All these conditions may be present at the same time. Peritonsillar and pharyngeal abscesses have been observed as sequella of the above-mentioned conditions.

The treatment of follicular cysts belongs under the heading of cyst operations and should not, therefore, be dealt with here.

For the relief of postoperative pain, two five grain tablets of aspirin taken every four or five hours will be found efficacious. At times, pyramidon, very rarely codeine or morphine, will be indicated. The aspirin should be taken as soon as pain is felt and the patient must not wait until it is severe before resorting to drugs. An ice bag applied ten to fifteen minutes every hour in case of swelling is very useful. A mouth wash of warm saline employed every hour must be insisted upon. For the first few days, fluid diet should be prescribed. The bowels must be kept regular.

Table I gives the actual number of malposed teeth, namely, 457, which were compiled from the author's records. The total number is then separated for the maxilla and mandible and these figures again divided in such

TABLE I

NUMBER OF MALPOSED TEETH: 457. MAXILLA—190. MANDIBLE—267.

| | MAXILLA | | MANDIBLE | |
|---|---|---|---|---|
| Deciduous | 3 | | 2 | |
| Deciduous With Cysts | 1 | | 0 | |
| Supernumerary | 11 | | 5 | |
| Supernumerary With Cysts | 2 | | 0 | |
| Permanent | 176 | | 261 | |
| Permanent With Cysts | 3 | | 6 | |
| Unerupted | 168 | | 171 | |
| Partly Erupted | 21 | | 128 | |
| Impacted | 19 | | 134 | |
| Partly Developed | 6 | | 16 | |
| Number of Malposed Teeth in one Mouth: | 2 | 3 | 4 | more than 4 |
| Number of Cases | 64 | 4 | 5 | 1 |

TABLE II

| MALPOSED TEETH IN MAXILLA AND MANDIBLE: 457 | | |
|---|---|---|
| Deciduous | 4 | – 0.9% |
| Supernumerary | 16 | + 3 % |
| Central Incisors | 9 | - 2 % |
| Lateral Incisors | 2 | - 0.5% |
| Canines | 109 | –24 % |
| First Premolars | 2 | – 0.5% |
| Second Premolars | 19 | + 4 % |
| First Molars | 2 | – 0.5% |
| Second Molars | 1 | + 0.2% |
| Third Molars | 293 | +64 % |

TABLE III

| MALPOSED TEETH IN MANDIBLE: 267 | | |
|---|---|---|
| Deciduous | 1 | –0.4% |
| Supernumerary | 5 | –2 % |
| Central Incisors | 0 | |
| Lateral Incisors | 1 | –0.4% |
| Canines | 10 | –4 % |
| First Premolars | 2 | –0.8% |
| Second Premolars | 14 | –6 % |
| First Molars | 2 | –0.8% |
| Second Molars | 1 | –0.4% |
| Third Molars | 231 | +86 % |

TABLE IV

| MALPOSED TEETH IN MAXILLA: 190 | | |
|---|---|---|
| Deciduous | 3 | – 2 % |
| Supernumerary | 11 | – 6 % |
| Central Incisors | 9 | – 5 % |
| Lateral Incisors | 1 | + 0.5% |
| Canines | 99 | +51 % |
| First Premolars | 0 | |
| Second Premolars | 5 | – 3 % |
| First Molars | 0 | |
| Second Molars | 0 | |
| Third Molars | 62 | –33 % |

a manner as to show the number of deciduous supernumerary and permanent teeth, etc. It is interesting to note that only 153 (19 maxillary and 134 mandibular teeth) of the total number were impacted.

In Table II are found the total number of maxillary and mandibular malposed teeth arranged according to the individual tooth type, giving their total number as well as the percentage.

Tables III and IV correspond entirely with the arrangement of Table II with the exception that the maxillary and mandibular teeth are separated.

The third molars in Tables II and III show the highest percentage, namely, +64 per cent and +86 per cent respectively, while in Table IV the canines show the highest percentage, being +51 per cent.

A satisfactory explanation for the cause or causes of the malposition of teeth is not known to the author. It is Dr. J. L. Young's belief that the tooth follicle is malposed before enamel is even deposited. Not enough attention has been paid to this subject, but one must admit from knowledge gained by past experience, that malposed teeth must be removed if they cannot be placed into their normal position.

# *DEPARTMENT OF DENTAL AND ORAL RADIOGRAPHY*

Edited By
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## ASEPTIC PULP CANAL SURGERY AND RADIOGRAPHY

(Tips in Technic)

By Howard R. Raper, D.D.S., Indianapolis and Albuquerque

### I

NO MAN can tell another how to practice aseptic surgery, any more than one man can tell another how to paint a masterpiece or write a meritorious novel. The practice of asepsis is an art. This is especially true of the practice of asepsis in a dental office. Fortunately for many general surgeons and their patients, the practice of asepsis as conducted in hospitals, is chiefly in the hands of well trained nurses. But the dentist, in his office, must be the monitor of his own asepsis. Only occasionally is a dentist blessed with an assistant with a sense of asepsis.

The general aim of the dentist I think should be to practice as little canal surgery as possible, but that little—and as the years go on let us hope it will become less and less, as we prevent its necessity—I say, that little should be aseptic.

Though it is true that asepsis cannot be taught in ultimate detail, one man can nevertheless help another by suggestions, which the other may accept if they appeal to him.

But no man can practice asepsis unless he has what I have called the aseptic sense. If he is told that after scrubbing his hands and rinsing them with alcohol he must not then make change for the laundry man, or answer the telephone, he must be able himself to see the reason why he must not do these things.

Here then are some tips in the technic of practicing aseptic canal surgery. They do not of course embrace all the knowledge necessary to practice asepsis; they are only boosts; you must do your own climbing.

Some sterilizer other than a boiling water sterilizer is necessary. I suggest a steam sterilizer so constructed that the steam may be turned into and out of the sterilizing chamber.

The problem of sterilizing all things that may be boiled, without injuring them, is very simple: boil for twenty or thirty minutes, then keep in a tightly closed formaldehyde case or sterilizer (?) where they will remain sterile until ready to use.

The problem of sterilizing those things which cannot be boiled is not so simple but it is not so difficult either. The *pulp canal package* is the solution to this problem.

The pulp canal package is made as follows: take a piece of unbleached muslin and in it place the following:

Three napkins.
Head covering for patient.
Dozen or two paper canal points.
Small bit of cotton about size of hickory nut.
Rubber dam.

Dozen or more gutta percha canal points. (No need to put these points in all packages. Mark the particular packages containing the gutta percha points. Do not allow the points to touch one another or they will stick together when subjected to the steam heat of the sterilization. Instead of including the gutta percha points in the *pulp canal package* for sterilization, it is perhaps more practical and satisfactory to keep them immersed in ethyl alcohol. This, to avoid subjecting them to heat, is recommended.)

Close the package and pin it. Make as many packages as desired.

The contents of the package may be changed in detail to suit different operators and the varying need of the same operator.

When pinned shut the packages are placed in the steam chamber of the sterilizer. As many packages may be sterilized at one time as the chamber will hold.

As long now as the packages remain closed their contents remain sterile, so open only as needed for immediate use.

It may be found convenient to open the package on the dental bracket, allowing the unbleached muslin to become a covering for the bracket table as the package is opened.

The technic for sterilization is as follows: Steam turned into the chamber about 50 minutes. Steam turned out of the chamber ("hot air") about 20 minutes, or long enough to dry the package. This is the technic with which I am most familiar. It is described here for that reason. I have no desire to disparage other efficient methods of sterilization.

Open a package for each canal patient at each sitting. An exception to this rule might be in cases of septic canals for the first two or three sittings.

It is not within the province of this article to discuss whether it is right or wrong to treat teeth with septic canals. However, in passing, I may say that if we do treat septic canals, it seems that our old method of sealing a treatment in a tooth and leaving it for several days is wrong. Disinfectant treatments should be changed about every 24 hours until disinfection is accomplished. This, I am told by those who have done experimental work along this line, requires about five or six treatments. Disinfection by the

ionization method suggested by Dr. Harry Johnston seems to me the most important development in this field of recent years.

Briefly Dr. Johnston's technic is as follows: Drug: Churchill's tincture of iodine. Pole: Negative pole. Milliamperage: One-half milliampere. Time: Twenty to thirty minutes. Canal filling: Immediate, Callahan-Johnston method.

But I wander from the subject at hand. All I had intended to say was—and perhaps it is worth repeating—the old method of leaving dressings in canals for several days is surely wrong.

The pulp canal package principle of practice is the most important "tip" the writer has to offer. In it, I believe, lies the key to the practice of aseptic canal surgery; you find the key.

Some other tips of less importance are:

(1) Spray the mouth or use mouth wash before adjusting rubber dam.

(2) Scrub the hands and rinse with alcohol again after adjusting the rubber dam.

(3) Sponge the isolated teeth and the rubber in vicinity, after adjusting the rubber dam, with ethyl alcohol, or paint with iodine, or both. (The Federal Government issues permits to dentists for the purchase of a limited amount of grain alcohol to be used for "sterilization or other nonbeverage purposes.")

(4) Use sulphuric acid in the pulp chamber and canals at each sitting, except there be some special and specific contraindication for its use.

(5) Have phenol and alcohol convenient to dip instruments into when expedient.

(6) Do not use the chip blower used for canal work for any other purpose. Sterilize it and keep it in the formaldehyde case or sterilizer (?).

## II

The necessity of having to O. K. canal fillings with the x-rays complicates the practice of asepsis.

We have learned to warn our patients, when we attempt canal work, that we may not be able to "get to the ends of the roots." But we have not learned (and we must) to warn them that even when we have succeeded in passing a "diagnostic wire" to the end of a canal it may then require several (one to four) efforts to fill the canal to or near to the end.

There are two general methods of practice: one is to prolong the sitting repeating the efforts at canal filling, and radiographing and re-radiographing until the canal or canals are filled. The other is to give the patient the time allotted, make one careful effort at filling, seal the tooth, remove the rubber dam, radiograph, and have the patient return the next day for a short sitting.

Both methods have advantages and disadvantages.

To practice the former method the operator must have his own x-ray machine or the radiodontist he patronizes must be in the same building.

On first thought the first method, i.e., that of keeping "at it" until the

canals are filled at the one sitting, seems the better one; but on analysis it does not appear so inviting.

Let us imagine a concrete case: We start at the point where the first effort at canal filling has been made. The tooth is, say, an upper premolar. We very frequently have to try repeatedly to fill even teeth with only one canal.

We are ready to make the x-ray exposure. We put the film in the mouth with difficulty for the rubber dam and dam clamp are in the way. (Our asepsis commences to slip away from us here.) Radiograms made with the rubber dam on are seldom as good as those made with the dam off for we cannot place the film in position as accurately. But if we remove the rubber we must first seal the tooth, then, in case of failure of the canal filling to "go where we put it," to quote Ray Kibler, we must adjust the dam again, (sterile dam?) scrub the hands again (?), sterilize the field again (?), open the tooth again and try again to fill the canals to the end.

Of course it is impractical to keep removing and replacing the dam at the same sitting so it is left on, and radiograms are made as well as can be under the circumstance and asepsis is maintained as well as may be under the circumstance.

Let us suppose now that two efforts at canal filling have failed. The "next patient" is waiting, the patient we are working for is tired and is commencing to "lose confidence in her dentist," the operator is worried and nervous; asepsis has, to use a crude but expressive phrase, been "lost in the shuffle." What should have been, say, a half hour or an hour sitting has stretched into an hour and a half or two hours. The very air is surcharged with irritation. The patient is mentally selecting her next dentist, the dentist swearing that he "does not believe in the treatment of teeth" and that he will "never treat another tooth."

The picture I have drawn is not in the least overdone. In fact I could give much less inviting pictures of the practice of treating teeth. I sometimes think that instead of our treatment of teeth being a disgrace to us as a profession it is to our everlasting credit that we have consented to do it at all.

There is less turmoil attending the practice of making but one effort to fill a canal at one sitting. It is disadvantageous to have the patient make repeated visits in some cases, but often the patient prefers a number of short visits to one long one.

There is a much better opportunity to practice asepsis by the one-effort-at-one-sitting method. The operator may start to apply this principle of practice by sealing his diagnostic wires, if he uses them, in the tooth with the medicinal agent of his choice and leaving them until the next regular sitting. And when it comes to filling the canal, one effort is made, the tooth sealed, the rubber dam removed, and the x-ray exposure made by the dentist or the radiodontist. At the next sitting, preferably the next day or perhaps the afternoon of the same day, in case it is necessary to make another effort, a new pulp canal package is opened, the usual routine of asepsis is followed, the effort at filling is repeated and the tooth sealed, and so on as before. To

practice asepsis the operator must have a system, a "stride" so to speak. So the foregoing can be repeated as often as necessary without any great damage to the practice of asepsis.

As stated, radiograms made with the rubber dam out of the way are usually better, and there is the added advantage in this latter method just described, that the negative is dry and mounted when studied. The study of dry negatives is much more satisfactory than the study of wet ones.

The practice of this latter method necessitates the use of some canal filling material which can be softened again in case the canal is not filled at the first effort. Fortunately, gutta percha, the best canal filling material, can be softened readily with chloroform or Callahan's solution. (Callahan's solution is a solution of rosin in chloroform of the approximate proportions of chloroform 3 drams, rosin 12 grains.)

Only the apical third of the canal should be filled first. That is to say, the coronal two-thirds of the canal or canals are not filled until after the filling in the apical third has been approved radiographically. This is done so that in case repeated efforts are necessary there will be the minimum amount of canal filling material to re-soften.

If the operator's technic for canal filling results in inadvertently filling all of the canal, the coronal two-thirds may be removed easily, while the material is still somewhat soft, by dissolving it further with chloroform and sponging it out with paper points. The operator who has never tried this method must not imagine that the canal filling left in a tightly sealed tooth for 6 to 24 hours gets hard like some of those he has encountered which have been in the tooth for years.

As stated at the beginning, both of the methods described have their advantages and disadvantages. (Pulp canal work is noted for its disadvantages.) However, in cases where several efforts are required to fill the canal, things move along more smoothly by the second method. Both the operator and the patient are less likely to become disgusted. And speaking of dissatisfied patients, the radiodontist often has the opportunity to shield the canal operator against injustice. After about two unsuccessful efforts to fill a canal the patient almost always commences to have doubts concerning the dentist's ability. Not infrequently he will intimate these doubts to the radiodontist, or the radiodontist, who has seen such patients before, can see the doubt written on the patient's face. It is now that the radiodontist has the opportunity to be of especial service to the dentist. A little assurance from him backed up perhaps by exhibiting some similar cases will change the patient's whole attitude.

Much might be said in this connection. However, I shall not say it—not now at least. I shall add only this: The operator who fills canals to the end is in constant and imminent danger of forcing some filling material through the end of the root, and when he does, it is a part of the duty of the radiodontist to protect him against the injustice of being blamed for this often unavoidable occurrence.

In the past I have said: First, that the ideal canal filling is the one

which reaches just to the end of the root. Second, that this ideal is impossible of consistent attainment. And third, that of the two mistakes, having the filling fall a little short of the end of the root or having it pass ("mush") through a little, the latter is more to be desired.

The first two premises still seem to me to be correct. But the third commences to look false. If it is true that Nature will, in certain cases, fill the apical foramina herself with "secondary cementum"* then certainly the filling which falls just short of reaching the end of the canal is better than the one which passes through.

I recall that in cases of pulpitis where the canal filling penetrates the end of the root there is often extreme pain, but, in the septic cases, when the filling "encapsulates the end of the root" there is usually no after pain. Is this Nature giving us a tip that it is permissible, perhaps right, to encapsulate in septic cases, and wrong to do so in pulpitis cases? I am inclined to think so. Secondary cementum, or "osteoid tissue" if you prefer that term, does not develop in septic cases I am informed.

However, it is not the time now to ask questions, or try to answer them; it is time to bring this paper to a close. There is so much more to be said about this old, old problem, that no matter where one stops one feels that the discussion has been "chopped short off."

In an effort to put some sort of a bob-tail ending to this discourse let me say: No matter how much there is yet to be learned about teeth and disease, is it not true that we already know this: that if we are to treat teeth at all we should treat them aseptically. Hardly a dentist but has seen some seriously sick person recover after the removal of teeth which were treated by the old septic methods. How dare we, in the face of this, return to former practices? It should be: *extraction or asepsis, one or the other.*

I am tired from writing and I feel as I usually feel after a prolonged discussion of the subject of pulp canal surgery: God protect the people and the profession from the necessity of treating teeth. We must prevent toothache.

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*Editorial Dental Items of Interest, September, 1920.

# THE TECHNIC OF ORAL RADIOGRAPHY

By Dr. Clarence O. Simpson, St. Louis

(*Continued from page 56.*)

## INTRAORAL EXAMINATIONS

*Advantages.*—The advantages of intraoral examinations over extraoral for the teeth and alveolar processes are: convenience in posing, accessibility to all regions, and better definition in the negatives. With the patient sitting erect in an operating chair, by merely changing the position of the head and rotating the chair, all poses for an intraoral examination may be secured. Direct access is available for examination of any region of the alveolar process, with the least possible interference from other structures. The definition in intraoral negatives is favored by the nearness of the film to the parts being examined, and the minimum amount of superimposed tissue.

*Technical Requirements.*—A "good picture" does not constitute an examination of a region, neither do a profusion of technically imperfect negatives, which leads to an enumeration of the essential qualities in radiographic negatives and examinations. The technical requirements of radiographic negatives are: (1) Covering the field of examination to the best advantage. (2) Showing no evidence of mobility during exposure. (3) Showing a diagnostic view of the region with the minimum distortion of the image. (4) Showing the maxium definition and contrast consistent with penetration of the structures. (5) Freedom from stains and abrasions. (6) Presenting a symmetrical projection of the image on the film.

*Objective.*—The objective of an intraoral examination is disclosing for diagnostic purposes the following structures: (1) An extensive periapical area to observe histologic changes, and reveal foreign or anomalous bodies. (2) The roots of the teeth with approximate accuracy, to determine the number, size, shape, and location. (3) The lamina dura entirely around the roots, which is a significant diagnostic index often indistinguishable because of technical deficiencies. (4) The crest of the alveolar process to reveal marginal destruction earlier and more accurately than by clinical inspection. (5) The pulp chambers and canals to determine the relation of the pulp to cavities and restorations, the access and course of canals for operations, and the relative efficiency of canal operations. (6) The proximal surfaces of the teeth to detect caries and deposits, and to observe the contact of the teeth and the contour of restorations.

To attain this objective and verify the evidence, two or more views of a region are required. When anatomic or operative difficulties are encountered, the examination should be continued to the limit of safe exposure or until every plan to obtain the information has been tried.

*Utility.*—Examinations which consistently approximate this standard are indispensable in oral diagnosis, and with negligible exceptions are an aid to all dental operations. Radiography is utilized to the full extent of its possibilities by few dentists, and too commonly is it neglected until complications with the probability of irremediable consequences arise. Since the x-ray offers a method of inspection which supplements all other means of examination, its use is an imperative *routine* procedure in dental practice, instead of being the last resort in severe disturbances and unsuccessful operations.

The value of periodic clinical examinations as a prophylactic measure is generally recognized, yet this is only a partial investigation of conditions which may lead to a false conclusion of security. Many features of a clinical examination can easier and more thoroughly be accomplished by the x-ray, which in addition may reveal vitally important information otherwise unobtainable. A mirror and explorer examination is especially inadequate for patients in whom oral sepsis is suspected by the physician, when the dentist's opinion is solicited in clearing the diagnosis. When the efficiency of dental operations is so dependent upon obscure factors, it is inexcusable to omit any precaution to safeguard the results. Appraised as a conserver of

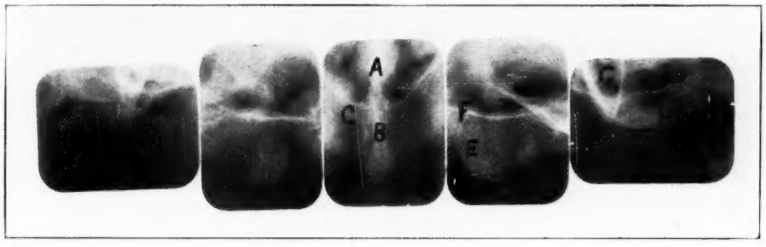


Fig. 1.—An illustration of radiographic landmarks in the maxillary regions. *A*, nasal spine and septum; *B*, incisive foramen; *C*, nostril; *D*, tip of nose; *E*, fold of tissue from muscular contraction; *F*, base of palatal process; *G*, malar process; *H*, malar bone; *I*, maxillary sinus; *J*, coronoid process.

function and health, radiodontic examinations are an economic service far exceeding the expenditure involved.

*Radiographic Landmarks.*—The regional anatomy has a distinct significance not only in interpretation, but in radiodontic examinations. There are several radiographic landmarks which present anatomic limitations in examination, identify negatives of edentulous regions, and produce confusing radiographic images. In the maxillary incisor region the *nasal spine* and *septum* present a radiopaque area between or above the central incisors; the *nose* obscures with a sharp line of demarcation an area which may include the roots of all the incisors; the *nostrils* form radiolucent zones suggestive of bone destruction over the incisors, the *incisive foramen* is recorded near the roots of the central incisors; and the *incisive fossa* forms a diffuse radiolucence around the lateral incisor.

In the maxillary canine region, the *levator muscles* when contracted or abnormally developed produce a fold of tissue with a diagonal line of demarcation about the middle of the canine root, which accentuates the increasing thickness of the alveolar process from the lateral incisor to the premolar

region, and the base of the *palatal process* presents a radiopaque horizontal line well above the roots of the teeth.

In the maxillary molar region, the *malar process* produces a U-shaped radiopaque line over the first and second molars; the *malar bone* increases the radiopacity over a large area in the second and third molar region; the *maxillary sinus* presents an extensive radioparent field which adds to the difficulty in determining periapical conditions of the premolars and molars; and the *coronoid* process is superimposed on the third molar region.

In the mandibular incisor region, the *mental protuberance* increases the radiopacity below the teeth, and obscures the apical area when the chin is prominent or a labial inclination of the incisors compels a low angle of projection.

In the mandibular premolar region, the *mental foramen* is recorded as a circular radiolucent spot near the apex of the second premolar, with the mental branch of the mandibular canal usually traceable to the foramen.

In the mandibular molar region, the radiopacity of the *external oblique ridge* is superimposed on the third molar and may obscure the roots when there is a pronounced lingual inclination of the tooth; the *mandibular canal*

Fig. 2.—An illustration of radiographic landmarks in the mandibular regions. *A*, mental protuberance; *B*, mental foramen; *C*, external oblique ridge; *D*, mandibular canal; *E*, thin portion near the angle.

with its radioparent lumen is near the apices of the second and third molar roots; and the thin portion of the bone is uniformly radiolucent as the *angle* is approached.

*Advantages of a General Radiodontic Examination.*—There are many advantages in making a general radiographic survey of the teeth and alveolar processes, instead of limiting the examination to the region of disturbance or a few teeth which may be under suspicion. Referred pain is so characteristic of the distribution of the fifth cranial nerve, that symptoms are often unreliable in locating the source of irritation, and a limited examination may leave important diagnostic information undisclosed. A general radiodontic examination rarely fails to expose some unsuspected abnormality or pathologic alteration, and leads to the correction of conditions. The discovery of obscure caries or incipient marginal absorption before irreparable harm has occurred, is of the greatest service to a patient.

Furthermore a radiodontic examination must not be depreciated when it does not reveal startling information, or explain existing symptoms, for it is no less useful in excluding possibilities and promoting a correct diagnosis. A general survey also has advantages in facilitating interpretation by giving the opportunity for comparison of different regions, showing the anatomic

modifications of the individual, and acquiring a store of radiographic data for study and subsequent application. When disturbances arise, radiographic records of a patient over a long period are most helpful in distinguishing histologic changes, in deciding upon the treatment to apply, and in judging the prognosis. A lamentable handicap in radio-diagnosis is the dearth of material for study and accurate deduction, due to the limited use of routine radiodontic examinations. One is constantly confronted by problems of etiology, chronicity, and resistance, even to questioning whether disease has developed in spite of treatment or as the result of treatment, and former radiographic records would be invaluable in deciding the issue.

*Outline of a General Radiodontic Examination.*—A survey of sixteen views is proposed as the minimum requirement of a general radiodontic examination. The systematic division of the dental arches into the sixteen areas to

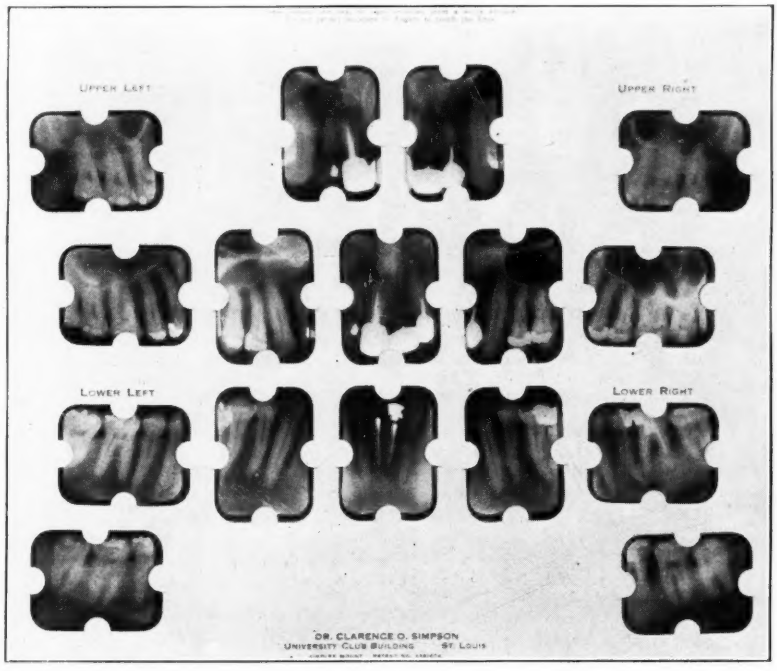


Fig. 3.—The sixteen views of a systematic general radiodontic examination as described in the text.

be described, tends to eliminate the usual confusing structures, and gives two or more views of each tooth excepting the third molars and the mandibular central incisors. The third molars are often absent, and the mandibular incisors are rarely the seat of disease other than marginal absorption which is readily disclosed in this region.

Three views are allotted to the maxillary incisors: one approximating the median line, grouping the incisors in the most favorable aspect; one directed at the left central and lateral incisors; and another directed at the right central and lateral incisors. The mandibular incisors are viewed in a direction conforming to the general inclination of these teeth. Each of the canines is shown in a separate view which includes an eccentric or diagonal aspect of the lateral incisor and premolars. One view is assigned to each

of the first molars, including the adjacent premolars and a diagonal aspect of the second molar. The second and third molars in each molar region are viewed from the most accessible point which gives an eccentric presentation of the first molar.

A general examination is intended as a routine inspection and not necessarily complete in that many conditions require extraoral examination, exploratory probes, or some means of localization; while for canal operations or surgical treatment, an exhaustive x-ray examination of a region may be indicated.

(*To be continued.*)

# *RADIODONTIC RIDDLES*

**Conducted by Clarence O. Simpson, M.D., D.D.S.**

**A Department Devoted to Discussion of the Scientific, Technical, and Ethical Problems of Radiodontia**

## Disloyalty in the Ranks

*My dear Mr. Editor:*—When a peaceably disposed individual feels that he needs a change and goes out looking for trouble, I really believe that if he will head towards some editor's desk, he will get more trouble, and trouble of a finer quality than is ordinarily handed out elsewhere.

So much for a starter. When you say that *the radiodontist* is the one to whom to refer "a family from my practice who is locating there," I take issue with you.

Just because St. Louis happens to possess one of the best radiodontists in the country, who is in a position to refer patients to capable dentists, don't you imagine for a moment that all radiodontists are first class, or in a position to recommend the best dentists in their own locality.

Let us assume a case. In a certain city there is one radiodontist, and quite a number of dentists have their own x-ray machines, and it just happens that these men are the very best dentists in that town.

Now, then, *your family* applies to this radiodontist for a dentist. Will he send your people to one of his friends who keeps him alive by always sending him all his x-ray work, or will he send them to one of the *leading dentists* who has never sent him a single patient? You need not reply, because the answer automatically writes itself in. *There are exceptions to all rules.*

As the case stands today, *and as I view it,* root canal work forms a good part of the work of the *leading* dentists. Root canals cannot be filled properly without an x-ray machine at one's elbow. I know whereof I speak. For some thirty years I filled (?) root canals without the use of the ray. Then I began to use the ray, and today it is not unusual for me to take four skiagraphs of the same root canal within the hour and with the rubber dam on. I could not possibly, under those conditions, refer such a patient to a radiodontist.

I spent two and a half hours (three sittings) this very week in an endeavor to remove a root canal filling from a simple upper second bicuspid, which a clinical examination showed was abscessed. I took six skiagraphs of the root while the work was in progress. At last I gave up. I extracted the tooth and found that it had three distinct roots and three distinct canals.

For a simple upper second bicuspid, this was doing well. When I saw the roots, I was resigned to my failure.

Therefore, I repeat, root canal work cannot be properly done without an x-ray machine in the office. Such being the case, every root canal filler should have a machine of his own. Such being the case, the radiodontist is about the last man from whom to seek advice in a case such as you are assuming. That is my opinion.

I am constantly asked this same question, and I get out of the difficulty—for it is a difficulty—in either of two ways.

1. I say, "Now just as soon as you get settled in your new place, you are going to make a lot of new friends. Ask some of them who their dentists are and all about them, and then make up your mind to whom to go."

2. I write to the dental dealer. Now there is the man who usually is "on to" all of his customers. He knows the kind of offices they keep, the instruments and materials they use, and he can "size up" the dentists, on his own account, pretty well. These "fellers" that are constantly coming in to sell us goods, we cannot put "anything over" on as a rule. They know the good and bad dentists in their town, and they have no special friends to favor, so I go to them.

Now then, friend Editor, I have had my say. Deal kindly with me, for I have a gentle nature. Yours very cordially,

(Signed) C. Edmund Kells.

**A.**—This correspondent announces that he is courting trouble, which is usually easy for a critic to find, but he is to be disappointed in this instance. Dr. Kells is too entertaining and too loyal a friend to be handed trouble, so to the contrary he shall have only stimulating pleasure from his criticism. Knowing that he cherishes an argument above all other human intercourse, he shall be gratified to the capacity of a two-finger typewriter and a friend of the cause.

It is no small distinction to be called to task by Dr. Kells, for he is a big game hunter in the professional field, an aristocratic critic who ignores the "small fry" writers, a king of literary toreadors who baits the harassed victims only in the publicity of the printed page or before a brilliant assemblage. However, too much conceit must not be drawn from the distinctive precedent, because the article criticized ended with a facetious reference to exodontists as the undertakers of dentistry, and Dr. Kells includes exodontia in his repertoire.

The gist of the criticism seems to hinge upon the given radiodontist being honest, not to his being in a position to know the ability of the dentists in his city. Then let the statement be qualified to read, "Give your patients a letter of introduction to an honest radiodontist, requesting him to refer them to the proper men for the attention required." This virtue was not specified, because the writer's conception of a radiodontist is a man who has the confidence of the profession in his city, and performs his professional duty without fear or favor. Quite true, faith is more efficacious when supported by caution, as the boy said when buying a coffin for his father, "Dad is not dead

yet, but the doctor said he would die before morning, and Doc knows what he gave him." Dr. Kells was the first radiodontist, so he knows the frailties of the clan, and as one of the organizers of the American Society of Dental Radiographers, he knows who is in it. Perhaps one who started with a Crookes tube cannot overcome his early impressions, and the present strain of radiodontists has been transformed by interrupterless rectification.

From the remainder and vulnerable portion of Dr. Kells' criticism the following conclusions may be drawn and refuted:

That ethics among specialists consists of "boosting" the dentists who refer the most work, which is not corroborated by intimate observation, and obviously would be an unwise policy. Rather are specialists inclined to commend every one through overzealous loyalty, or as a cynic might interpret it, to promote practice. If a specialist were bidding for patronage, he would refer patients to men who were not supporting him in hope of winning favor. Furthermore, "leading" dentists have a full practice, and one would refer a patient to them rather as a privilege than as a bribe.

That "leading" dentists do all the radiodontia, orthodontia, exodontia, periodontia and oral surgery which can be made profitable, and "send out" only the prosthetic work so it can also be made profitable. Such men are not "leading" dentists, but avaricious exploiters of dentistry who deceive no one in the profession but themselves with a "one-man organization."

That canal operations form a good part of "leading" dentists' work, when some of our leading dentists are so far ahead of the profession that they remove all pulpless teeth and do no canal operations. Seriously, yes, canal operations form a good part but not a large part of a general practice for people educated in preventive dentistry.

That root canals cannot be properly filled without an x-ray machine beside the chair. Canals cannot be properly filled without the aid of radiography is admitted, but that they cannot be properly filled without x-ray examinations during the operation is disputed. Dr. Raper opportunely discusses this question on other pages of this issue, with the conclusion that canal operations can be done better and easier by systematic operating following the radiographic examination than by the endurance or "job" method. Dr. Edouard Hall, a foremost exponent of efficient canal technic, who not only fills canals properly but probably is unexcelled as a canal operator, refers his patients to a radiodontist for the x-ray examinations. Many other operators, including the writer, have performed canal operations according to present standards with unstinted assistance of radiography, and found greater efficiency in having the radiographic examination before or after rather than during the operations. It is the undeniable privilege of any one who so chooses to have an x-ray machine at his elbow for "fluoroscopic" canal operations, but it is always an autocratic injustice to state that a thing cannot be done under certain conditions when one means *he* cannot do it.

After radiographing a tooth six times during the progress of the work, doubtless hurriedly with the dam in place, Dr. Kells found only after extraction that the tooth had three roots and three canals. Another argument for

doing a thing thoroughly, and one thing at a time. A radiodontist entrusted with the examination probably would have shown the three roots. Had Dr. Kells, who is an exceptionally competent radiodontist, concentrated on a thorough radiographic examination in advance instead of "just peeping" during the operation, the prospect of a success would have been more favorable.

The two plans which Dr. Kells follows in placing patients in other cities, seem most unlikely to prove satisfactory. The first, asking new friends about their dentists and then deciding, was warned against in the original article because of the dentists selected by apparently intelligent people when influenced by friends, social testimonials, lodge grips, or church affiliations. Give this a trial in your home town by asking several people who do not know your vocation to recommend a "good" dentist, or recall the testimony offered at an informal gathering when dentists are being discussed. Every one—except children—thinks his or her present dentist is the best, and those who have been under the care of skillful practitioners, who charged commensurate fees, are prone to denounce them.

The other plan of writing to a dental dealer is no more promising and is asking too much of those sociable fellows who have already assumed the responsibility of equipping, technical instruction, and business training of the dentist, and the dental education of the laity. The dental dealer knows who have the show offices, buy the most supplies for quantity production, contribute most to his mechanical laboratory, and swallow his efficiency "dope," but what does he know or care about the character of operations? The dealer is engaged in profitably turning over stock, heeding the master voice of the trust, selling spring styles in equipment to the "fall guys" in dentistry, and collecting money from some dentists who are more conscientious than dollar conscious.

Lastly, let it be placed on record that no suggestion in this department applies to Dr. Kells, because it is written by an ordinary man for ordinary men; and in all seriousness and sincerity, Dr. Kells is an extraordinary man. He does most things differently and most things better than ordinary men. He is a radiodontist, and when you wish your patients or friends to have the proper dental attention in New Orleans, ask the advice of Dr. Kells, an honest radiodontist—and more.

# *ABSTRACT OF CURRENT LITERATURE*

**Covering Such Subjects as**

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA — DENTAL RADIOGRAPHY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

**High Frequency in Dentistry.** Neff and Longoria (Cleveland). The Dental Summary, November, 1922, xlii, 11.

The high frequency electrode is a valuable accessory to the treatment of all suppurations and may be visualized as a spray conveying a strong antiseptic solution, which is at the same time a stimulant of normal cell growth. It is used after the abscess is opened and irrigated and in pyorrhea after the preparatory mechanical treatment. Under these conditions the surface electrode is applied for ten minutes. The operator may draw the current through his own body either by placing his finger on the opposite side of the tooth about which the abscess has occurred, or by holding a flat metal-handled instrument firmly against the tissues—the back of the mouth mirror answers this purpose well enough. In thus "grounding" the patient a five minute contact suffices for that particular manipulation. The ordinary application of the surface electrode may be repeated at intervals if there are troublesome complications, such as enlarged cervical glands. This after-treatment may be carried out by an assistant.

The theory of electrons shows that electricity and the vital processes are ultimately one and the same, so that in nearly devitalized tissues high frequency may add to the residue of vital energy. This is another way of stating that the current increases the power of assimilation. It may also act indirectly by cataphoresis, forcing solutions of chemicals into the affected tissues. Thus iodine is broken up into its ions and may be used for the treatment of apical infections. A longshanked broach is wound with cotton, dipped in iodine and held opposite the apical foramen. After a little delay an assistant holds the surface electrode with mild current a few inches from the patient, while the operator completes the connection with the mouth mirror, the shank of the broach being picked up in the shoulder of the mirror handle, the end of the latter coming in contact with the electrode. If the contact is properly made the patient experiences a tingling feeling. The metal handle must be partly covered with vulcanite where it is to be grasped by the operator's hand, but when the contact is first made one finger may rest on the metal. Another step necessary for "grounding" the patient is to place

the ball end of a steel instrument against the tissues nearest the apex of the tooth. There are further particulars of technics too long for reproduction here. A third use of high frquency is in desensitizing dentine in which a solution of cocaine and special electrode is used. The patient is "grounded" at the root apex. After three minutes' delay the operator may begin to excavate. Similar technics may be used in filling slight cavities in abraded dentine.

**Focal Infection in Cases with Pulpstones.** W. F. Dunlop (New York). The Dental Digest, November, 1922, xxviii, 11.

The following case occurred some years ago, before it was the custom to make diagnostic x-rays of the teeth. There was no suspicion that the neuritis in this patient had been the result of dental trouble, for the teeth had been in excellent shape. The woman limped into the office (she was normally without gait troubles) simply to have her routine quarterly dental examination. She claimed that she could not bear her weight on her soles without extremely painful muscular spasms, and had been forced to wear crutches. The dental examination showed oxidation of an amalgam filling in an upper molar. Thinking the nerve might be dying he drilled into the tooth and came upon a pulp stone of good size, firmly adherent to the pulp. He had seen these formations cause a quiet paralysis but never a painful spastic affection. The woman had been under treatment with heat and electricity, evidently without benefit. An arsenic mixture was introduced into the cavity and the latter sealed. When she left the chair there was not the slightest pain and lameness, and the condition was permanently cured. However at a later period there developed a neuritis in the left shoulder. Recalling the first experience the author opened up a second cavity in the upper left lateral, and as before the pain at once vanished.

**Radiant Energy and Dentistry.** A. A. Nouel (Caracas). The Dental Summary, November, 1922, xlii, 11.

The author enumerates some of the facts of intraatomic physics. The electron is 1800 times smaller than the atom of hydrogen and is subject to its own individual movement of rotation or oscillation. The vibrations of electrons are believed to be synchronous and harmonious, and since something is lost by the friction of free electrons this loss may require to be made good in some manner, so that the atom may be likened to a living organism. The electrons are believed to appropriate or select vibrations from without in accordance with their special requirements, the selection being made from the length and frequency of the ether waves. In metals there is also a loss of electrons and a consequent tendency to disintegrate. One might assume that the radioactive elements are unable to select the special vibrations needed, suffering therefore from a defect of assimilation. However, the author's explanation of radioactivity is the exact reverse, to-wit, that these elements have an unusual affinity for waves of varying length and frequency,

and a greatly heightened power of assimilation. From this viewpoint the radium atom is not dying out but is very much alive. The author also mentions the possibility that ability to overassimilate may cause increased speed of electronic rotation, so that finally some of them are thrown from their orbits.

The author believes that electrical energy may be assimilated by the atoms. Tesla, by placing a strip of tin in a solenoid, causes the former to explode, while a piece of steel may be liquefied. Heat cannot explain these phenomena. The body cells are not influenced at all by these oscillations of the solenoid and as this is inconceivable *per se* it must be that these organic cells can somehow extemporize a defense. The latter seems to be due to the nervous system, as if it might be made to vibrate in a particular manner and thereby absorb the shock, but of course this is pure hypothesis. The author believes that atoms of living cells may, like those of metals, suffer from disorders and loss of electrons, and that high frequency may be able to make good this kind of loss, restore harmony to the oscillations, or liberate electrons which may have become interlocked. This works out in the world of metals. In dental practice there is a large field for the application of high frequency, but the author is chiefly interested in introducing the vibrations through the tooth cavity to influence favorably the resistance of the extra-apical region towards microorganisms.

The principal contention of the author is that by using a metal pulp-cavity electrode attached to a high frequency machine in which the last winding works by induction, a certain effect is produced in the region concerned which can be demonstrated by a sensitized photographic plate. Technical details and illustrations fail, and doubtless will appear in a subsequent effort.

**Food and Feeding in Relation to the Teeth.** J. Sim Wallace (London). The Dental Surgeon, November, 1922, xix, No. 943.

The carbohydrates in part—sugars and cooked starches—undoubtedly stand in some close relation to modern dental caries. Lactic acid is formed during their mouth digestion and this substance can under favorable conditions attack the enamel. There is also formed a gummy adhesive substance which facilitates the action of the acid. Raw starches, including cellulose, are free from these objections. Cellulose, although innutritious, is one of the causes of mastication. As there is an abundance of carbohydrate in staples like bread and potato, sugar is at least unnecessary and the author does not even approve of marmalades on bread. Butter and cheese are more rational to give sapidity to bread.

Caries is of course due to the fact that enamel is practically a dead substance—a veritable natural prosthesis. Once injured it cannot rejuvenate itself and once lost it cannot be replaced. Crevices which retain the food and allow it to stagnate form a link in the process, and adhesive and fermentable food another. To add excess lime to the diet serves no useful purpose for with or without lime the molars decay tenfold more rapidly than the

front teeth. The growth and size of the teeth are predetermined and have nothing to do with the amount of use they get, but food which requires plenty of mastication before it can be swallowed certainly is a factor in the proper development of the jaws. If these are subdeveloped the teeth will be poorly implanted, and thus the way will be paved for caries through food adhesion and stagnation. Apples are in some respects ideal as food for they require some chewing, and the acidity by provoking a flow of alkaline saliva cleanses the mouth. Mastication of the apple is also a mechanical factor in cleansing and the residue does not lodge in the teeth, and if it should can do no harm.

One can readily convince himself of the properties of the apple as a dentifrice and tooth brush by watching himself. The mouth after mastication will both look and feel clean. Then let him substitute cake or pudding and note the state in which they leave the teeth. There is no residue of organized cellulose to act mechanically and no flow of alkaline saliva to irrigate the teeth, the molars being covered with the sweet, sticky substance. Both caries and pyorrhea may develop according to the individual and the age.

Neither antiseptics nor the brush can offset this tendency and our only recourse is a wise selection of food, not so much for the entire meal as for the last dish eaten or drunk. No drink should be taken with the food if the latter is of the sweet and sticky type and if such dishes are taken at all it should be midway in the meal. A cup of unsweetened black coffee at the end of the meal has a cleansing effect. Toasting bread by increasing mastication is a good way to take the carbohydrate. The article will be continued.

**Radium Therapy in Periapical Infection.** J. A. Marshall (San Francisco). The Journal of the American Dental Association, December, 1922, ix, 12.

The author is able to confirm some earlier statements favorable to the use of solutions of radium emanation products in periapical infections. He works in the radium laboratories of the University of California. The investigations had started in 1919 with radium chloride in association with a vanadium salt, and were disappointing. Later, capillary tubes of radium emanation were obtained, such as are in use in the treatment of eye and skin diseases. Emanation is of course gaseous but certain of its disintegration products are soluble solids. Disintegration goes on continuously and is complete when the gamma rays of emanation are no longer given off. The products are generally known as radium D and E and give off beta rays. Solutions are made by crushing tubes of altered emanation in Ringer's solution. As they are not permanent it is best to use them at once. The solution is therefore carried into the roots of the teeth on sterile cotton points which are sealed in from one to four days. After this the pulp canals are tested and filled. If tested for sterility the cavities are opened and the crowns and adjacent areas flooded with alcohol and painted with a 1 per cent solution of crystal violet and dried with hot air. The cotton points are next removed and fresh ones introduced successively to remove all moisture. Other points are now sealed in with gutta percha and cement. This second packing is removed in 24

hours and tested for bacterial life with various culture media. It was found that the strength of the solutions varies from 1.20 millicuries in 1 c.c. of solution to 2.76 and that the amount actually left within the teeth varies from 0.06 to 0.138 millicuries. The class of patient treated with radium has been as a rule the cases which resisted ordinary treatment; and of these the majority to the radium. As the class of patients were generally regarded in the clinic as hopeless the results were striking. The shortcomings were not due to the radium but to unsuccessful sterilization or imperfect filling. No teeth treated with radium have yet been lost. Failure to obtain sterilization in this or that case cannot be accounted for. In the successful majority the x-ray shows the apical area in good condition. The author fixes the percentage of successes at 85. In the remaining 15 per cent it is not to be expected that any other measures can cure.

**Psychology and Prosthesis.** E. H. Bruening (Omaha). The Journal of the American Dental Association, December, 1922, ix, 12.

The author is a believer in the relationship between physical and mental types, his views being taken from empirical sources without any form of biometric control. His types do not cover those of Bryant, Goldthwaite and other moderns. The alimentive or, as some have called it, visceral type, inclines to stoutness and overfondness for eating, with a tranquil mentality. Neither bodily nor mental activity is favored. The respiratory type has an unusually well developed breathing apparatus, leads an active and aggressive life, and naturally is given to athletic exercises and occupations requiring endurance. The overmuscular type is obvious to any one. While the author has a special osseous type, this is usually fused with the preceding as the motive type, for as a rule large bones and well developed muscles are associated. The nervous type or temperament is also too obvious to require description.

In addition to the five types of the author, each of which requires special study from the standpoint of prosthesis, there are the proportions of the art anatomist, such as "the distance from nose to mouth should be twice that from mouth to chin." The statement that "two-thirds of the head should be in front of the ear orifice," is rather hard on the normally brachycephalic man, whose backhead seems abnormally short, and is equally inapplicable to some of the extremely dolichocephalic Nordics and African negroes. The author should have made racial type a prime factor, for his measurements seem to imply that the normal man is mesocephalic.

**Destruction of Apical Infection.** H. B. Johnson (Atlanta). The Journal of Dental Research, March, 1922, iv, 1.

The conclusions of the author are given by him as follows: Having stated that for the past six years he has ionized each infected or suspected tooth before filling, using for the purpose and with marvelous results the old Churchill tincture of iodine, the technic of which he describes in great

detail, he adds that he has ceased the use of canal medication before filling, this procedure having been supplanted by electroionization as above mentioned. This eliminates the use of all powerful escharotics. All medication and manhandling in general are mischievous, for there should be a minimum of trauma produced, whether chemical or physical.

Nature having placed a remarkable resource in our hands we should supply a proper technic. The means for filling perfectly the root canals already preexist in each pulp and in the ideal pulp canal filling this force must be utilized. In all but three of 150 pus cases a thirty-minute period of ionization has been sufficient to stop the discharge, while the sinus closes completely in 24 to 48 hours. The current strength is half a milliampere, the electrochemical strength of iodine being 19 or almost four times the strength of its nearest competitor, zinc.

**A Visit to the Mayo Clinic.** C. E. Kells (New Orleans). The Dental Cosmos, January, 1923, lxv, 60.

The author gives a brief account of a visit to Rochester with a society of exodontists. He is frank in praising as well as criticizing. The plant leaves nothing to be desired, but it is not employed to the best advantage. The staff are above all surgeons and the dominant idea is extirpation of unsound and doubtful tissue. They do not amputate in the leg to cure infection of the ankle joint and they are capable of treating sinus infection without extirpation but at present the teeth are ordained to go. Once infected, a tooth root stays infected and the only course is eradication. In this course they are opposed to thousands of dentists, but their sample cannot fail to influence many of the latter. They send their operative patients back home with x-ray charts of infected teeth and directions to have the dentist extract them. The author sees these charts but disregards the advice entirely. Yet probably he is thought insane for opposing such high authority. It is true that the ordinary dentist cannot afford the expense of such charts and it may be well enough to make them as part of the management of the case but why order that removal be carried out? In the meantime every busy dentist may see alveolar abscess disappear permanently after filling root canals. The author mentions one thus healed after 27 years and now the x-ray shows that conditions are satisfactory. As for young dentists who personally visit the Mayos, they sometimes come away filled with enthusiasm for surgical exodontia (not simple extraction). Some are not blind to the fact that fees for surgical exodontia are considerably higher than those for mere tooth-pulling. The author believes that not one tooth in a hundred needs anything beyond simple extraction. Every practicing dentist has plenty of chances to see that teeth are often needlessly pulled.

As a rule the author's patients sustain him in his conservatism, both before and after extraction. The case is cited of a woman who against his advice had all her doubtful or infected teeth surgically removed by the Mayo dentists. Wearing an artificial denture, she complained that her general ailments had not improved and that she had no comfort from the false teeth. She

is only one of a group and throughout the country there are thousands like her.

The attitude at Rochester seems to be largely due to results of animal experiment. An abscess is set up about the tooth of a dog and it is shown later that an intestinal infection has developed as a consequence. But why not give a modern dentist a chance at that dog? Such a man would treat the tooth antiseptically and seal up the root canal with antiseptic cement. Very probably the intestinal infection would be thwarted. Then if the dog were later killed it would be possible to see whether or not the conservative treatment had completely eradicated the infection.

**The Dentist's Responsibility.** B. L. Brun (Baltimore). The Dental Cosmos, January, 1923, lxv, 1.

Recent writings of authorities on the part played by buccal lesions in causing systemic and focal affections have yet to be fully coordinated. To what extent separate lesions in the body are to be correlated is still far from understood. Two or more lesions may be quite independent of one another, or both may originate in a general basic condition, or one may be directly responsible for the others. The dentist is able to diagnosticate the intrabuccal condition and is not to be held responsible for the relation of this lesion to others in the body. A relationship may be evident or very likely in some cases, and entirely obscure in others. He can hardly commit himself to the view that the buccal lesion is responsible for a distant local process or a general infection in the absence of a complex examination of the entire individual. Should these conditions improve after dental treatment that is no proof whatever that the buccal lesion was the essential cause of the mischief. But the dentist can so treat the teeth, alveoli, gums, etc., that all absorption of poison or germ life can be cut off and his responsibility should end there. In thus functioning he should not feel obliged to elect the radical course of procedure by sweeping extirpation of all tissues which are not only known to be infected but are even under suspicion. At present we seem to be at the peak of a radical-treatment wave which is based on the unwarranted assumption that the systemic or focal condition is due directly to the oral condition and that without radical management it will become worse and a menace to life, health and usefulness. The dentist at times has an added responsibility when requested by the family physician to undertake this radical treatment. Should he lean on the responsibility of the medical colleague, or refuse to carry out the request? Under the circumstances the dentist is justified in assuming his own responsibility of choice of procedure.

**The Dentist and Cancer Prevention.** Editorial in the Pacific Dental Gazette, December, 1922, xxx, 12.

Considering the great activity, organized and individual, in the province of cancer prevention, it is somewhat surprising to find so little in this direction in the dental journals. The dentist must often be the first to see incip-

ient cancer within the mouth, and to see precancerous conditions like smoker's patches must be an everyday experience. The editor wrote on this subject editorially in 1913. Of the 90,000 or thereabout cancer deaths in the United States annually, between 3000 and 4000 are due to cancer of the oral cavity. It has never been any part of the dentist's work to treat these cancers in the early stages, when alone there is a possibility of cure, but he should realize that if he does not do his duty by warning the patient and then sending him to an expert surgeon there will be a long delay during which the individual will gradually come to realize his condition and then probably, while perhaps still curable, gravitate to some advertising cancer quack who will take all his money and afford him neither a prospect of cure nor even of relief from the severe suffering. The dentist often has occasion to treat precancerous conditions without actually pretending to do so. Sometimes the physician in cases of suspicious lesion requests the dentist to remove or smooth down ragged teeth and roots but aside from this all dental treatment directed against irritation of the mouth by teeth or prosthesis in the elderly subject is incidentally preventive work against cancer.

**Sensitive Dentine.** W. C. Smith (Toronto), Oral Health, January, 1923, xiii, 1.

There has been and is still going on an earnest search for some substance or agency which will obtund sensitive dentine. Of the many obtundants tested with some benefit it may be said that none gives enough relief to offset the trouble of application. Local analgesics, while giving temporary relief, may be followed by ill effects even to the point of devitalization. General anesthesia is efficacious but quite out of the question as a routine procedure. In both infiltration and conduction anesthesia we have resources suitable for special occasions, but, like the preceding, unsuited for routine. There is no one cure-all for dental pain. In working on sensitive dentine sharp instruments inflict much less pain than blunt ones. The edges should be freshened often. If the operator understand the exact thickness of the enamel he may be able to avoid going into the dentine when this is unnecessary. Once the enamel has been cleanly removed, the pain from cutting the dentine is brief. Of tropical substances the author mentions sealing into the cavity a mixture of paraform, cocaine and oil of cloves. When dentine has to be operated on continuously for a long time a mixture of intraosseous and conduction anesthesia is recommended. In shallow cavities near the gum, ethyl chloride spray is valuable. Psychological handling of nervous subjects is indispensable, as shown by the fact that many patients employ a dentist whom they know will hurt them, although they are convinced that he is more sympathetic than ordinary.

# The International Journal of Orthodontia, Oral Surgery and Radiography

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-809 Metropolitan Bldg., St. Louis, Mo.

**Foreign Depots**—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

**Subscription Rates.**—Single copies, 75 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $6.00 per year in advance. Under foreign postage, $6.40. Volume begins with January and ends with December of each year.

**Remittances**—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter payable to the publishers, The C. V. Mosby Company.

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Entered at the Post Office at St. Louis, Mo., as Second-Class Matter.


# *EDITORIALS*

## Orthodontic and Oral Radiographic Technic

STUDY and Experience are the Pathways to Skill.

We feel that we can serve our readers no better than by placing before them the experience and skill of men who have intensively studied, and through earnest effort have acquired skill in, their particular specialty.

This issue marks the beginning of the Department of Orthodontic Technic. Each month a discussion of elementary orthodontic technic will be published. The department, in charge of Dr. H. C. Pollock, Associate Editor, will be conducted primarily for the benefit of many of our readers who are seeking knowledge of more elementary orthodontia than is usually published under the head of original articles.

The January issue of the Journal contained the first of a series of articles by Dr. Clarence O. Simpson covering the Technic of Oral Radiography. Experienced radiographers will find Dr. Simpson's articles interesting and helpful, while beginners in the field, after reading one or two, will find them a necessity.

## Dental Orthopedia and Prosthetic Correction of Cleft Palate*

THE second edition of this work, like the first, has been written with the idea of giving Dr. Case's opinions on dental orthopedics. The entire work has been prepared for the purpose of showing his plan of treatment and how it differs from some of the other accepted ideas. Any one who has read his writings during the last few years, knows that Dr. Case has very definite opinions in regard to malocclusion and his treatment of certain types of deformity does not agree with many others.

Some parts of the second edition have been rewritten with an attempt to make Dr. Case's writings conform with the writings of other men. For example, in his preface, Dr. Case states that "The present and second edition of this work, which now bases malocclusion upon the dento-occlusal classification has required a complete rewriting and readjustment of nearly every department."

In the first edition, the author presented a plan of classification which has been carried out in this edition but with slight modification. He has attempted to place the malocclusion in three classes, which seems to be more or less a favorite plan, but a careful perusal of his table of dento-facial malocclusion would show conflicts which are very apparent to a casual observer. Class I is designated as "normal disto-mesial occlusion of the buccal teeth" which probably means the same as the generally accepted interpretation: normal anteroposterior relation of the arches.

While it is true that the buccal teeth are more or less characteristic of the arch relation, nevertheless we can see no reason for placing emphasis on the occlusion of the buccal teeth, when we find that the buccal teeth on one or both sides of the arch may be disturbed anteroposteriorly without disturbing the arch relations as compared to the face and cranium. In this class he places "bimaxillary protrusions and retrusions." Dr. Case had been able to find more cases of this type of malocclusion than any other one man and even if they exist to the extent to which he claims they do, it is questionable whether they should be classified as conditions in which the arches have a normal anteroposterior relation to the face and cranium.

Class II, he described "distal occlusion of lower buccal teeth," which again we think would be better described as posterior occlusion of the mandibular arch. He has divided Class II into "Division 1 and Division 2," which is a similar division made by Dr. Angle several years ago. Dr. Hellman called attention to the fact that a great many so-called "Class II, Division 2" are not distal occlusions but only neutroclusions with mesioversion of the maxillary molars and premolars.

We believe Lischer's classification of arch relations is much more scientific than either that of Angle or Case and especially is Dr. Case's arrangement of Class II misleading because a conflict exists in his own description. In fact, he describes Class II as a "distal malocclusion of the lower buccal teeth," then he describes Class II, Division 2, as a "protrusion of the upper

*Dental Orthopedia and Prosthetic Correction of Cleft Palate. By Calvin S. Case, M.D., D.D.S. Published by C. S. Case Company, Chicago. Price, $10.00.

with lower normal." Any condition which has a protrusion of the upper with lower normal is not Class II or "distal malocclusion of the buccal teeth" as Case calls it. Protrusion of the upper is not a posterior relation of the mandibular arch.

Such conditions as Dr. Case describes under Class II, Division 2, in which we have a normal position of the mandibular arch, are neutroclusion, conditions with mesioversion of the maxillary molars and premolars in Class III which is devoted to so-called "mesial malocclusions of the lower buccal teeth"; it would be better if they were defined as anterior relations of the mandibular arch. His grouping is confusing because of certain malocclusions which creep in Class III which do not belong there.

Under the first group, Division 1 of Dr. Case's Class III is described a bodily protrusion of the maxillary denture and maxilla with lower normal. It is impossible for us to see how you can have a mesial malocclusion of the lower buccal teeth when the lower is normal. Likewise, Division 2 is described as protracted retrusion of the upper denture, but in the table no mention is given as to whether the mandibular arch is normal or abnormal.

It seems to me that as a result of this, he has simply succeeded in complicating the mind of the student, and his classification of arch relations is far inferior to those suggested by Dr. Lischer several years ago.

When we come to the etiology of malocclusion, it is a well-known fact that Dr. Case holds decided opinions on the questions of heredity as a factor in the production of facial deformities. As a result of this, a great many of his treatments are based upon so-called "etiological factors." He devotes a considerable portion of the book to a review of the laws of biology and refers to various writers on heredity and draws conclusions which are not in keeping with the statements of many other men who have written on the subject of heredity.

Dr. Case quotes freely from papers he has prepared at various times and also from the writings of others. Some of the references to the works of other men are taken with the idea of substantiating his point, while in some cases he refers to the works of some authors for the purpose of criticizing them.

One objection from a scientific standpoint is that the author has allowed personalities to creep into the book, which may be more or less interesting to the older practitioner, but which will be of little value to the modern student.

The work contains a chapter on the question of extraction, which is based on some of Dr. Case's views on the causes of malocclusion, but in the majority of cases he indicates that a number of men have not yet conceded that extraction is necessary in that type of malocclusion.

The chapter on the principles of mechanics in the movement of teeth is well written, and probably more space is devoted to that phase of orthodontics than is found in any other textbook. Many pages are given to the question of bodily tooth movement and the literature during the past few years is extensively reviewed. Bodily tooth movement has long been one of Dr.

Case's main principles of practice and we can excuse him for devoting so much space to the subject regardless of the fact that the majority of teeth in malocclusion can be successfully treated without bodily tooth movement. Some of the illustrations shown in the book are good, while others lose a great deal of scientific value because they are made from models which are so extremely small. A large number of facial casts are shown. Probably facial casts possess a greater value than has been admitted by a number of men who are inclined to photograph their patient.

The book is written according to the clear, concise manner which is always followed by Dr. Case, and in fact is a presentation of his personal views and opinions, some of which we agree with, others of which we have to respect because Dr. Case has devoted his life to working along certain plans of treatment. Regardless of whether we agree with him or not we must admire him for his earnest and sincere work for the advancement of the profession.

The portion of the work devoted to the prosthetic correction of cleft palate is probably more of a masterpiece than that portion of the book on dental orthopedics.

Dr. Case long ago became interested in the treatment of cleft palate by prosthetic restorations and has developed a technic for taking impressions and making of obturators which is far superior to any other plan followed today. He has paid considerable attention to phonetic principles and this chapter in itself would be worth the price of the book. Any one who has followed the construction of obturators and seen some of the things which have been forced on patients today cannot but admire the technic of Dr. Case.

There are a great many things in the book which we admire, a great many things which we cannot agree with, but the work is one that possesses many merits from a scientific standpoint, and whether one may agree or disagree with the author, he will obtain much information by reading the book from beginning to end.

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## Orthodontic Impressions and Casts*

FOR a number of years men who have been engaged in the practice of orthodontics have worked towards the improvement of the technical side of impressions and casts. Many have contributed to this phase of orthodontic science, but it remained for Dr. Herbert A. Pullen to gather this material into one volume and present it as a monograph.

The book is intended for the use of students in undergraduate schools of dentistry where accurate cast-making has often been indifferently talked about, due to the lack of any standardized methods. The monograph consists of ninety pages, eighty illustrations, and the subject matter is well covered.

*Orthodontic impressions and Casts. By Herbert A. Pullen. D.D.S., P. Blakiston's Son & Co., Philadelphia, Price, $1.50.

We, however, question the real need or value of this book owing to the fact that at the best it is only an elaborate chapter on impressions and casts which might well form part of any text on orthodontics. In fact, several books published on the subject of orthodontics contain all of the important features of impression and cast making that are shown in this monograph.

When we consider the fact that students receive impression instructions in the prosthetic department and are forced to buy text books on prosthetic dentistry, crown and bridge work and orthodontics, we cannot help but believe that the recommendation of a book on the subject of Orthodontic Impressions and Casts for the undergraduate students, is questionable. To the practitioner of orthodontics who desires a complete review of all phases of orthodontic impressions and casts, including both plaster and modeling compound, this book is recommended.

It is our belief that the book would have been improved upon if the subject of duplication of orthodontic casts had been included, which technic is just as important as the technic of modeling compound impressions. The illustrations are very clear and the whole is a good piece of book-making. It is bound in an attractive cover and will make a nice addition to any orthodontic library. The subject matter is prepared in that careful and detailed manner that is characteristic of the author.

# *ORTHODONTIC NEWS AND NOTES*

### The New York Society of Orthodontists

The second annual meeting of the New York Society of Orthodontists will be held at the Vanderbilt Hotel, afternoon and evening, March 14, 1923. All ethical dentists interested in the practice of this specialty are cordially invited to attend. William C. Fisher, Secretary, 501 Fifth Ave., New York City.

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### Alumni Society of the Dewey School of Orthodontia

The next annual meeting of the Alumni Society of the Dewey School of Orthodontia will be held on April 12 and 13 at the Edgewater Beach Hotel in Chicago. The usual high standard of the meetings of this society will be maintained. All interested in orthodontics are cordially invited to attend these meetings. George F. Burke, Secretary, David Whitney Building, Detroit, Mich.

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### The Eastern Association of Graduates of the Angle School of Orthodontia

The fourteenth annual meeting of the Eastern Association of Graduates of the Angle School of Orthodontia will be held in New York City, at the Vanderbilt Hotel, Park Avenue and 34th Street, on Monday and Tuesday, May 7 and 8, 1923. E. Santley Butler, Secretary, 576 Fifth Ave., New York City.

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### Notes of Interest

Dr. Ernest N. Bach announces the removal of his office to 915 Ohio Bldg., Toledo, Ohio. Practice limited to orthodontia.

Dr. Leonard T. Walsh announces the removal of his office to 414 Thatcher Bldg., Pueblo, Colo. Practice limited to orthodontia.

Dr. J. H. Williams, 724 Metropolitan Building, St. Louis, Mo., announces that in the future his practice will be limited to orthodontia and the care of children's teeth exclusively.